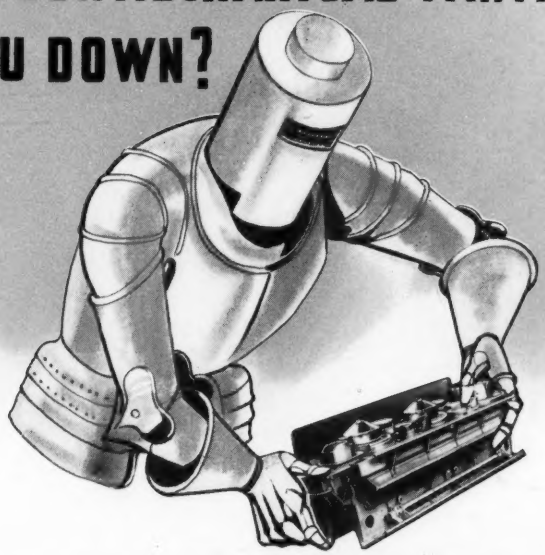
MARCH 1937

WIRE AND WIRE PRODUCTS

DOES YOUR *MECHANICAL* PARTNER LET YOU DOWN?



In meeting your customers' demand for quality, price and service—in satisfying, also, your own need for efficient, low-cost production—*you have two active partners.* One is *equipment.* The other is *man-power.*

Does your equipment carry its full share of the load? Or does it throw an extra burden on man-power by stealing time and efficiency—and consequently, profits? ● *These are fair questions!* Let us help you work out the answers.

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WIRE DRAWING MACHINERY

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OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

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684

MANUFACTURER'S TRADE MARK YOUNGSTOWN WIRE

That Intangible "Something"

. . . backed up by FACTS!

In the people whom you meet, that "intangible something" is personality. In the firms with which you deal, it is not so easily labeled. It is partly expressed in terms of service, quality and results obtained. One manufacturer calls it the "priceless ingredient" of his products. It is well named.

To us, it means a conscientious endeavor to render the highest degree of service through the coordinated facilities of our manufacturing, sales and engineering departments; it means the constant desire to keep that service ahead of the other fellow; to continually seek new ways and means of improving our product for the benefit of our customers. It also means a willingness to tell you frankly when we feel our product will not be of benefit to you on your particular applications.

To us, all of these factors combine to make up that intangible something which is part and parcel of every firm in varying degree. It is, however, meaningless unless backed up by tangible results.

In the case of Carboloy dies these results take the form of greater die life per hole size, less scrap, better finish, less rejections and an improved, more economical product. Carboloy representatives will be glad to tell you more about these results and how they may be obtained in your plant.

CARBOLOY COMPANY, INC.

DETROIT, MICHIGAN

CHICAGO - CLEVELAND - NEWARK - PHILADELPHIA - PITTSBURGH

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Canadian Distributor:
Canadian General Electric Co., Ltd., Toronto, Ontario

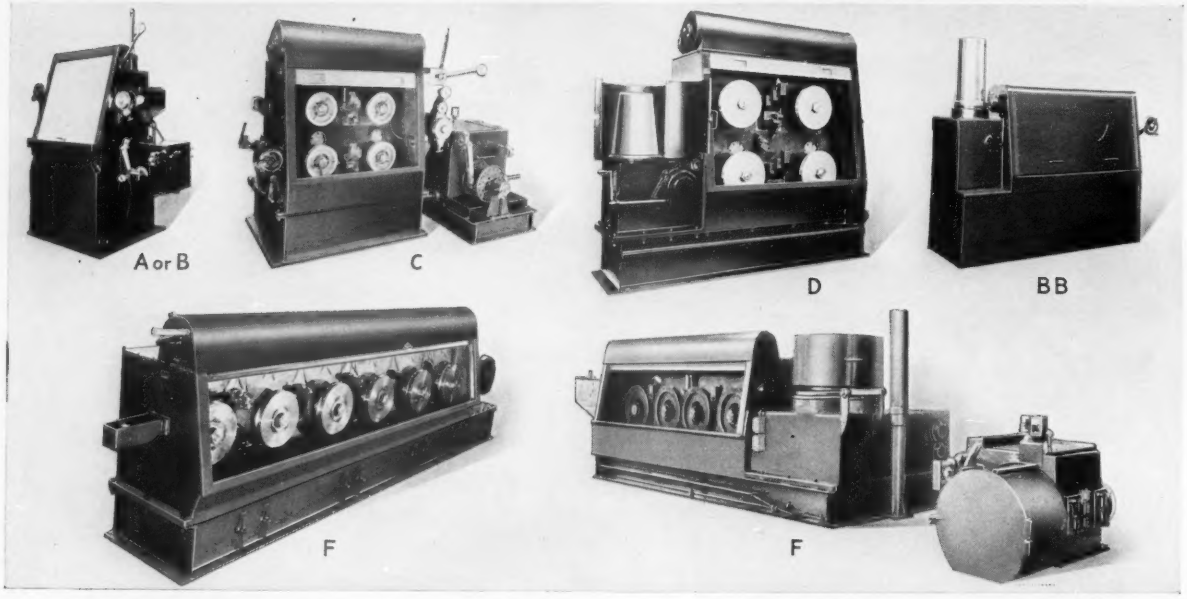
The Mark of CARBOLOY
REG. U. S. PAT. OFF.

CARBOLOY REG. U.S. PAT. OFF. **DRAWING AND EXTRUSION DIES**

ADV. D73—WIRE & WIRE PRODUCTS—MARCH

WIRE & WIRE PRODUCTS, Vol. 12, No. 3, March, 1937. Executive office, 17 East 42nd St., New York, N. Y. Published by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secretary and Treasurer. Publication office, 13 West Church Street, Washington, N. J. Subscription price: U. S., $5.00; Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office, Washington, N. J., under Act of March, 1879.

WIRE DRAWING EQUIPMENT



A complete line, minimum slip, wire drawing equipment built primarily for high speed wire drawing production. Liberal proportioning, anti-friction mounting, efficient power transmission, freedom from belts or chains, positive variable speed drive to spoolers to maintain uniform wire speed, accurate wire tension control at the point of spooling are a few of the features contributing to long life, efficient operation, economical production, clean and excellently wound quality wire.

Type of Machine	A	B	C	D	BB	F
With or without Spoolers	Yes	Yes	Yes	Yes	Yes	Yes
With or without Coiler	Yes	Yes	Yes	Yes	Yes	Yes
Size of finished wire B & S gauge	#34-#44	#26-34	#18-26	#12-22	#26-34	#2-#12
Number of Dies	16	16	12 or 13	13	13	5-7-9-11 or 13
Finished Wire Speed-FPM	5000	5000	4000	3500	2500 to 3500	2500 & 1000

High Speed Insulating Machines
For use with Paper — Cotton — Silk

Saturating and Finishing Equipment
For Weatherproof and Code Wire

Taping Machines for Cambric and Paper

Take-ups — Spoolers — Coilers

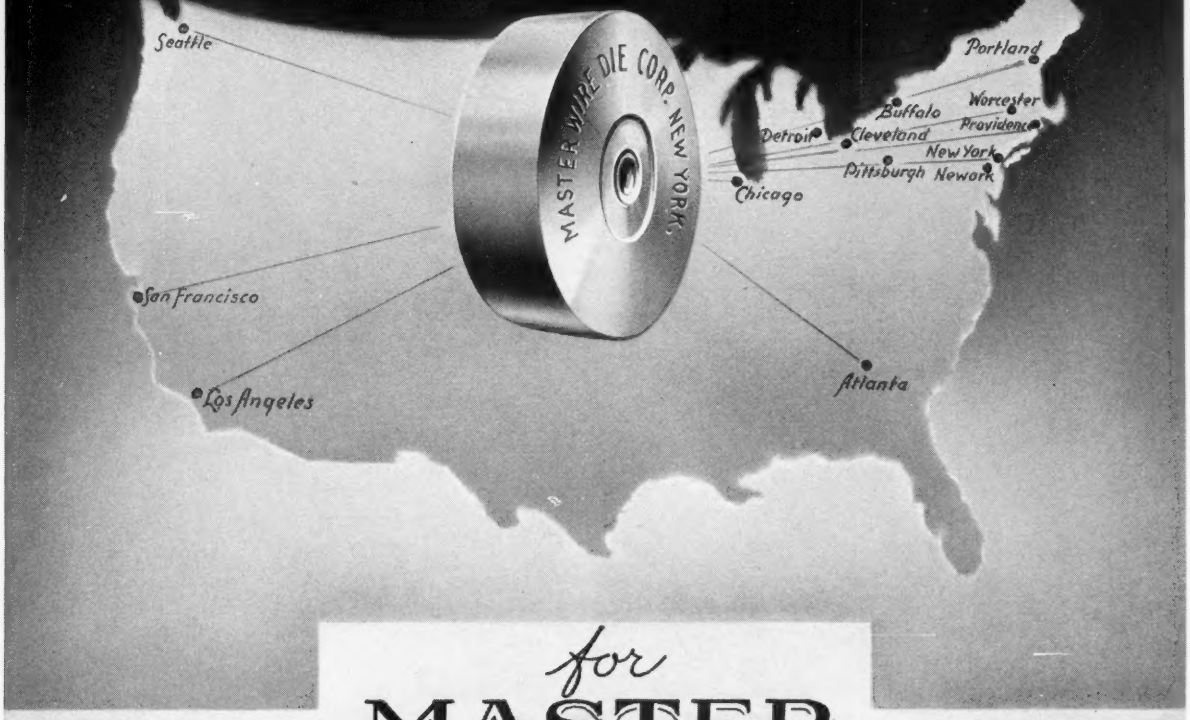
Complete Tinning Equipment

Other Equipment for Producing
Wire and Cable

ELEVATOR SUPPLIES COMPANY, Inc.

HOBOKEN, N. J.

There's a NATION-WIDE DEMAND



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The Master Wire Die Corporation places at the command of industry everywhere an organization long-experienced and expert in manufacturing wire drawing dies of every description—a service deep-rooted in long research and study in the development and final fabrication of a precious, almost jewel-like, precision built MASTER DIE, the like of which there is no counterpart.

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PRECISION ACCURACY
TRADE MARK

"HUDCO" PRODUCTS...
Specially Processed Copper Wire...

▲ ▲ ▲ Electrolytic and Oxygen Free ▲ ▲ ▲

▲ ▲ ▲

WIRE---
ESPECIALLY MADE FOR METALLIZING

Pure Lead
Lead Alloy
Pure Zinc
Zinc Alloy
Copper
Tin
High Brass
Low Brass
Solder Wire
Cadmium
Nickel Silver (10%, 18%, 30%)
Aluminum
Monel Metal
Phosphor Bronze
Pure Nickel
Commercial Bronze

"HUDCO"
High Conductivity Electric Wire

✦ ✦ ✦

BRUSH WIRES, CRIMP and STRAIGHT
Brass, Steel, Nickel Silver, Copper and Phosphor Bronze

✦ ✦ ✦

TINSEL LAHNS
Silver Plated Copper, False Gold and Copper

✦ ✦ ✦

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Commercial Bronze
Phosphor Bronze
Pure Tin
Lead
Antimonial Lead
Cadmium
Nickel Silver, 10%, 18% and 30%
Silver Plated Copper
False Gold and Special Brass and Bronze Alloys to Specification

▲ ▲ ▲

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and enameled wires in all Standard and Special Covering ▲ ▲ ▲
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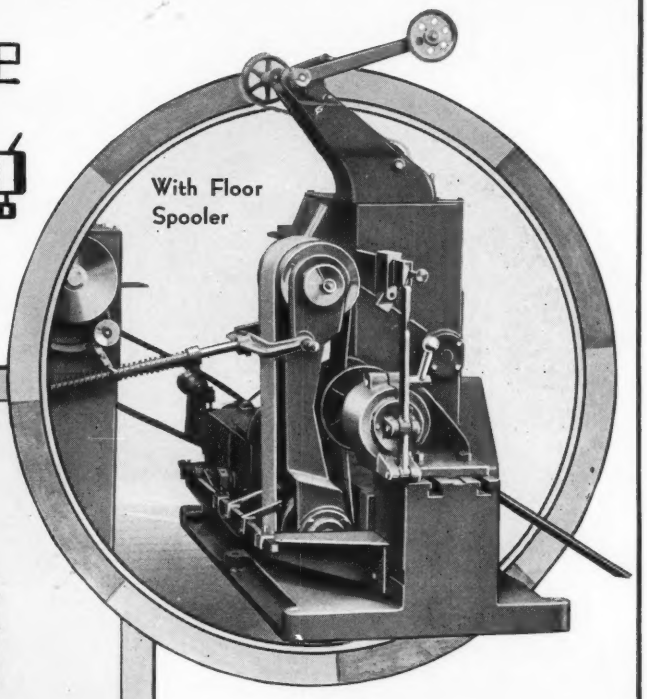
Send in your specifications for a quotation.

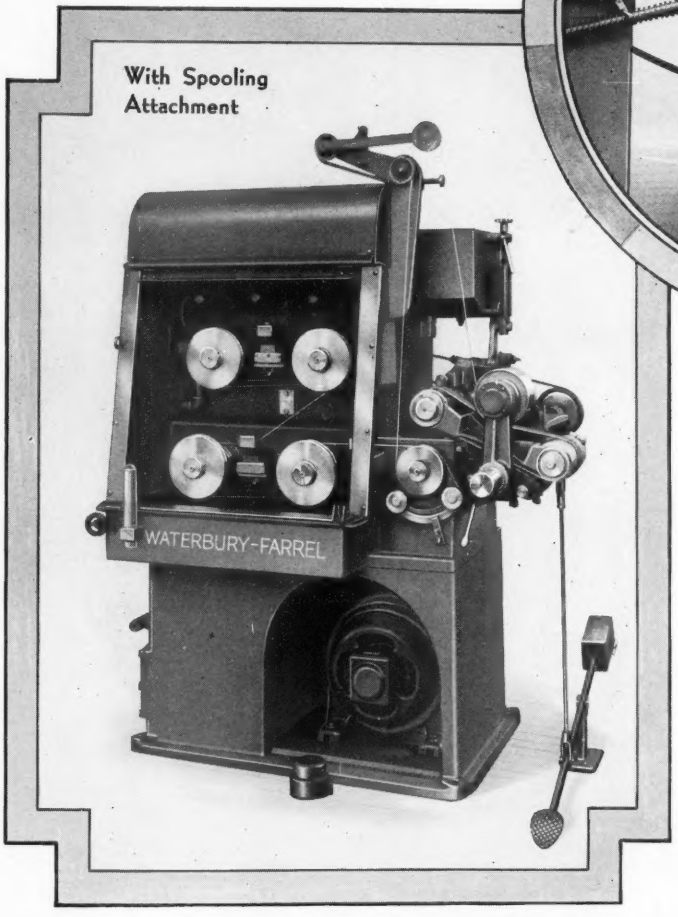
HUDSON WIRE COMPANY
Ossining, N. Y.

Estab. 1902 — Successors ROYLE & AKIN — Estab. 1902

Waterbury-Farrel

Upright Cone Wire Drawing Machines . . .





HIGH SPEED

These high speed machines are built in four standard sizes and are intended primarily for copper wire. We illustrate the drum type construction with spooler.

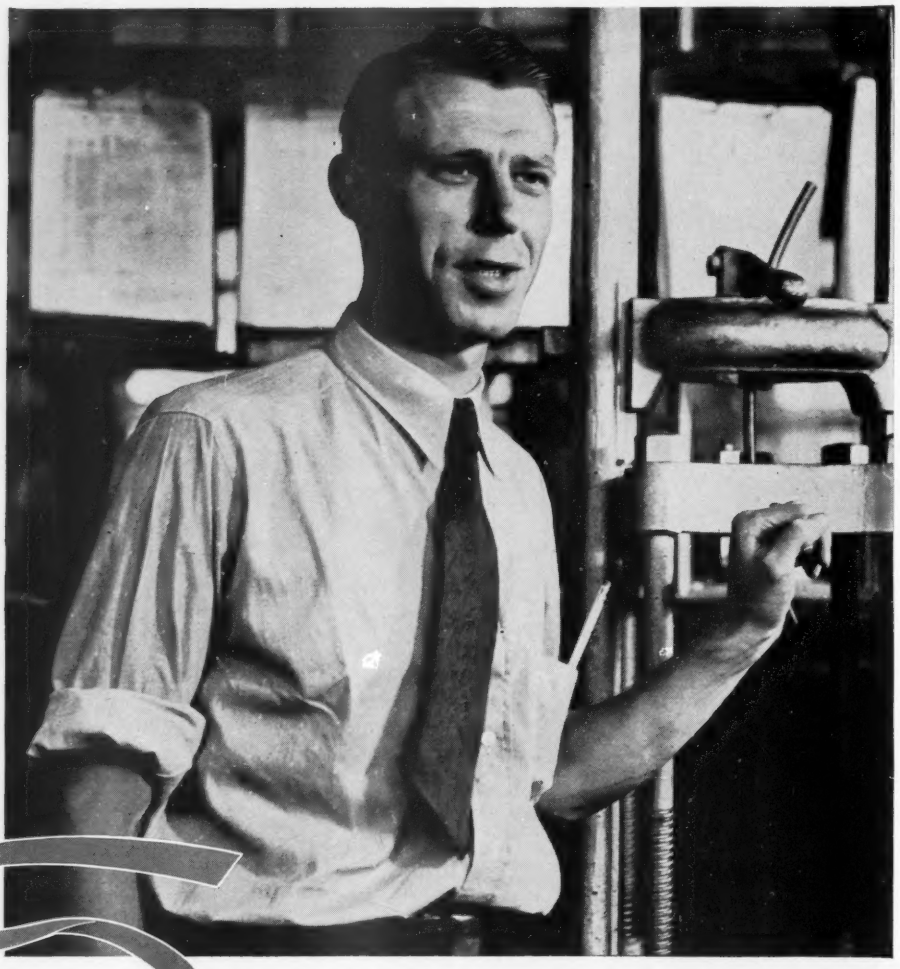
Similar machines with adjustable block and reversing mechanism are available. These have been designed especially for brass and other non-ferrous alloys.

For further particulars consult our Engineering Department.

The Waterbury Farrel Foundry and Machine Co.

HOME OFFICE AND WORKS: Bank and Meadow Sts., Waterbury, Connecticut

CLEVELAND CHICAGO NEWARK, N. J.



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You make the specifications. This man sees that they are lived up to. He's No. 1 inspector in a "Pittsburgh" mill and his precision measuring machines and true testing methods are your guaranty of uniform stock. Our engineers always are available to help you determine the right wire to fit your operating conditions, and our inspectors, responsible only to mill executives, are there to see that you get what the specifications call for. Please feel free to request the services of our engineering department at any time.

Pittsburgh Wires
FOR EVERY PURPOSE

PITTSBURGH STEEL COMPANY • 755 UNION TRUST BLDG. • PITTSBURGH, PA.

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PHILADELPHIA SYRACUSE CHARLOTTE HOUSTON LOS ANGELES SAN FRANCISCO

Spring Wire • Chain Wire • Box Binding Wire • Lavite Annealed Wire • Cold Heading Wire • Core Wire
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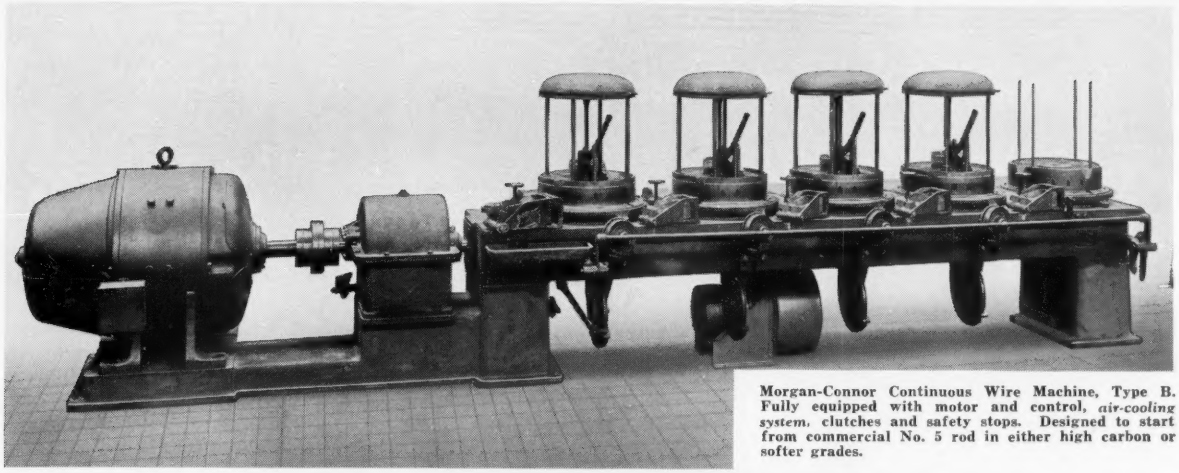


Morgan-Connor Continuous Wire Machine, Type B. Fully equipped with motor and control, *air-cooling system*, clutches and safety stops. Designed to start from commercial No. 5 rod in either high carbon or softer grades.

PROFITS

Morgan-Connor Wire Machines function as coordinated units to increase drawing speeds, improve quality and to assure uniformity in the finished product — important factors in profitable wire drawing procedure.

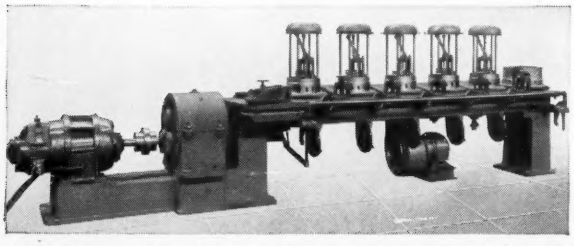
Excess bulk is eliminated, floor space is saved: compact strength is manifest in every part of a Morgan Machine. Rugged flexibility coupled with lower maintenance costs mean greater tonnage per unit — more profits per ton.

The high block design — an exclusive Morgan feature — allows ample storage between dies; eliminates slippage and provides for proper cooling. Air cooling of wire by forced draft available where required. Withdrawal of wire from each block is effected by uncoiling rather than unwinding. Die wear is reduced.

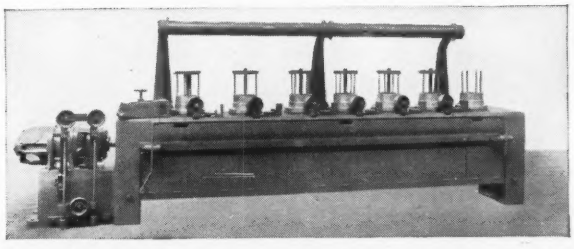
Ample safety features protect the operator. Morgan-Connor Wire Machines demonstrate that they are production units that help labor and floor space pay dividends.

MORGAN CONSTRUCTION COMPANY

Worcester, Massachusetts, U. S. A.



Morgan-Connor Continuous Wire Machine, Type C—air cooled. Fully equipped with motor and control, clutches and safety stop. Machine takes wire either hard drawn or annealed. Patented wire can be started at about 11 gauge.



Morgan-Connor Continuous Wire Machine, Type D. This machine is designed especially for the drawing of finer sized wire. Starts from No. 17 patented wire.

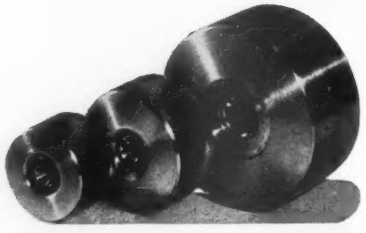
W-13

MORGAN *Wire* Machines

MORGAN WORCESTER ENGINEERS AND MANUFACTURERS

DIAMOND DIES CARBIDE DIES
UNWIDIE

"Not a better die
but the best"



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WEAR LONGER
PRODUCE MORE WIRE
AND
LOWER YOUR COSTS

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip Wire Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 12 MARCH, 1937 No. 3

Designated as

Official Publication By The Wire Association

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There is a Vascoloy-Ramet Die for every job, and especially for yours.

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Vascoloy-Ramet Division
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On any product where burnishing is advantageous FIRTHALOY Dies will produce surprising quantities.

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GLOBE WIRE DIVISION, McKEESPORT, PA.

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING--- EXTRUDING --- FORMING --- FABRICATING

Vol. 12 MARCH 1937 No. 3

Recovery of Steels From Acid Brittleness

PART II

By Sydney Coppick

McGill University, Montreal, Canada

Part (6)
Results

THE following tabulated results and their graphical representations comprise tests performed on the following steels:

Sample (1)

A cold drawn, low carbon, rivet quality, mild steel.
Diameter ⅜ inch.

C	.08
P	.021
S	.036
Mn	.23

✦ ✦ ✦

Sample (2)

A cold drawn, low carbon, machinery steel, adaptable to threading and use as shafting.
Diameter ⅝ inch.

C	.09
P	.044
S	.308
Mn	.72
Si	nil

✦ ✦ ✦

Sample (3)

A rivet steel similar to sample (1), but of higher manganese content.
Diameter ⅜ inch.

C	.08
P	.014
S	.034
Mn	.42

✦ ✦ ✦

Sample (4)

The same as sample (1), but annealed.

✦ ✦ ✦

Sample (5)

A medium carbon structural steel.
Diameter $\frac{5}{16}$ inch.

C	.36
P	.026
S	.030
Mn	.68

✦ ✦ ✦

Sample (6)

A high carbon drill rod, used for machine work.
Diameter $\frac{1}{16}$ inch.
C 1.0% (approx.)

✦ ✦ ✦

THE very nature of the results requires that they be graphically represented in some detail, and the significance of these plots cannot be dealt with individually, but is discussed collectively in the next section, devoted to that topic.

✦ ✦ ✦

Table of Symbols Used in Plotting and Calculating Results

THE following table is a list of the symbols used in plotting and tabulating the results.

E	Energy expended to fracture specimen as per Sankey specifications. (in foot pounds.)
$E\theta$	Energy expended to fracture at time θ.
E_u	Energy expended to fracture at infinite time, i. e. at complete recovery.
E_h	Energy loss due to hydrogen, i. e. the embrittlement.
E_c	Critical energy loss due to hydrogen, i. e. the embrittlement at end of the rapid rate of recovery period.
E_o	Energy expended to fracture specimen immediately after pickling, i. e. when $\theta=0$.
$\frac{dE}{d\theta}$	Time rate of recovery of energy lost in foot pounds per hour.
k	$\frac{dE}{d\theta}$ for the initial constant rate period.
T	Temperature of baking in degrees Centigrade.
θ	Time of recovery or baking in minutes.
t	Time of pickling in minutes.

$$\% \text{ Recovery} = \frac{E\theta - E_o}{E_u - E_o} \times 100$$

The % recovery of the energy loss, due to occluded hydrogen.

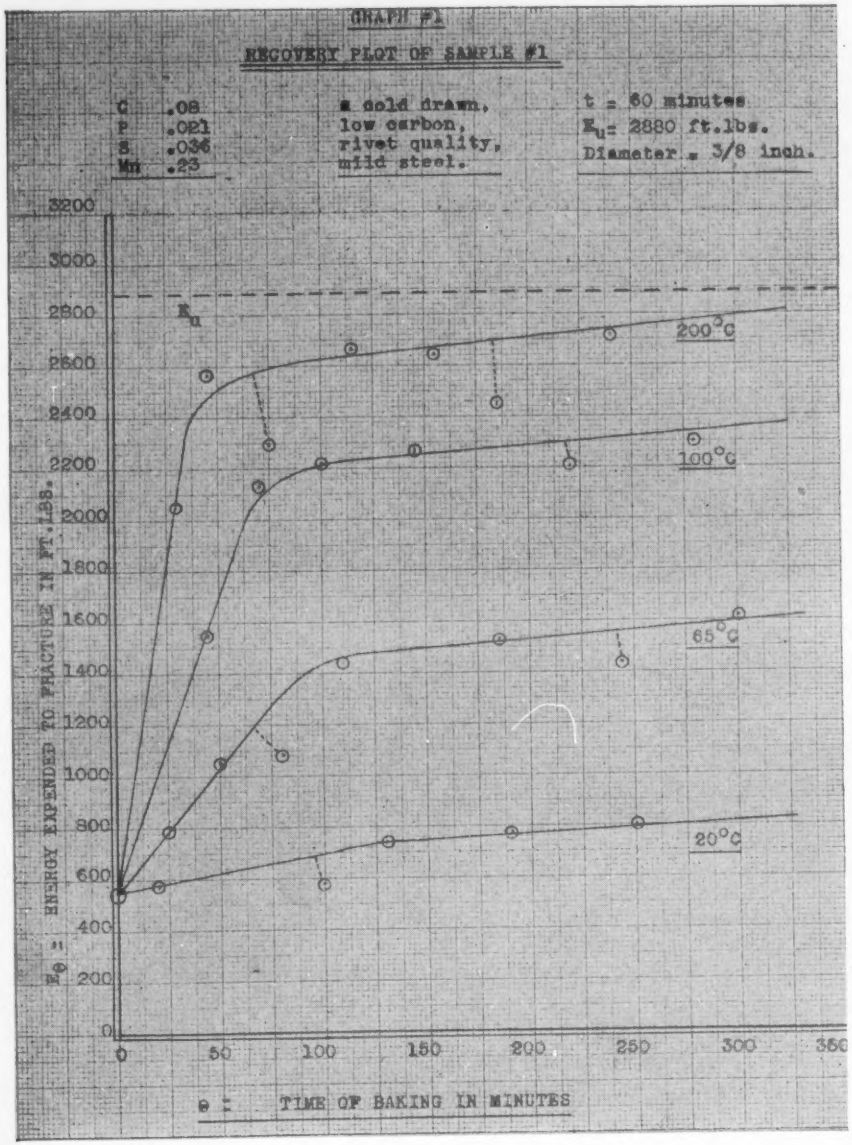
Contents

Part (6): Results.
Part (7): Discussion and Interpretation of the Results.
Part (8) Conclusions.
Bibliography.
Part I Published in February, contained:
Object of the Investigation.
Part (1): Theoretical and Historical Introduction.
Part (2): Commercial Application.
Part (3): Alternative Method of Solving the Problem.
Part (4): Apparatus.
Part (5): Procedure.

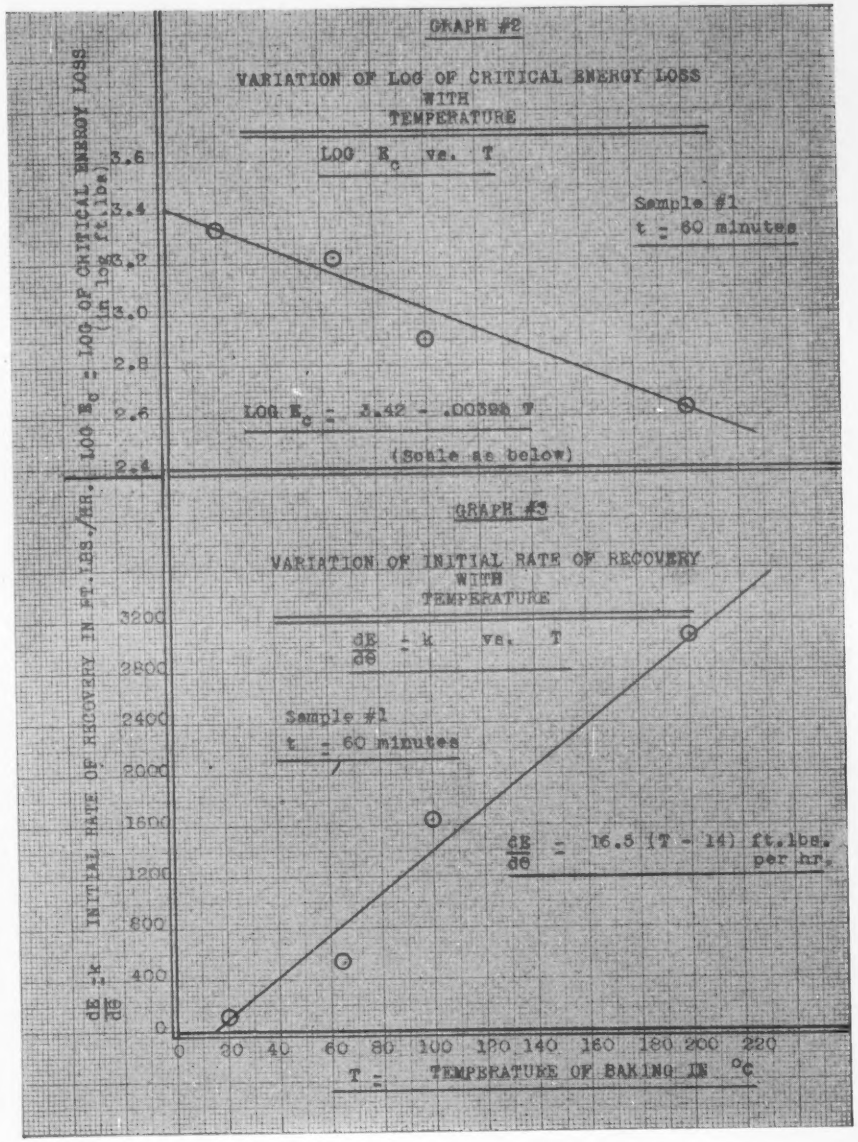
Acknowledgment

The writer desires to express his sincere thanks to Professor Gordon Sproule for his kind advice and aid during the prosecution of this investigation.

Also, to the Dominion Steel and Coal Corporation many thanks are due for their interest and the information provided by them, as well as the supply of material on which the experiments were conducted.



Graph No. 1.


GRAPH #2
VARIATION OF LOG OF CRITICAL ENERGY LOSS WITH TEMPERATURE
LOG E_c vs. T
Sample #1
t = 60 minutes
LOG E_c = 3.42 - .00326 T
(Scale as below)
LOG E_c = LOG OF CRITICAL ENERGY LOSS (in log ft.lbs.)
GRAPH #3
VARIATION OF INITIAL RATE OF RECOVERY WITH TEMPERATURE
$\frac{dE}{d\theta}$ = k vs. T
Sample #1
t = 60 minutes
$\frac{dE}{d\theta}$ = 16.5 (T - 14) ft.lbs. per hr.
$\frac{dE}{d\theta}$ = k = INITIAL RATE OF RECOVERY IN FT.LBS./HR.
T = TEMPERATURE OF BAKING IN °C

Graphs No. 2 and No. 3.

SAMPLE NO. 1

TABLE NO. 1

Sample (1)	T=20°C	t=60 min.	E_u=2880 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	9.25	37	548
15	10.0	36	577
103	10.0	36	577
133	13.0	35	730
193	14.5	33	765
253	15.0	33	795
1183	16.0	33	845
1200	20.0	33	1060
1500	21.6	33	1140
1620	23.2	33	1220

TABLE NO. 2

Sample (1)	T=65°C	t=60 min.	E_u=2880 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	10	36	577
23	14	35	785
50	20	33	1050
80	21	32	1075
110	28	32	1440
185	31	31	1530
245	29	31	1435
300	31	31	1610

TABLE NO. 3

Sample (1)	T=100°C.	t=60 min.	E_u=2880 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	9.5	36	547
40	28.5	34	1550
70	40.5	33	2140
100	42.0	33	2220
145	44.5	32	2270
220	44.5	31	2210
280	43.5	33	2290
400	46.5	31	2310
520	50.0	30	2510

TABLE NO. 4

Sample (1)	T=200°C.	t=60 min.	E_u=2880 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	9.5	36	547
30	41.5	31	2050
45	57.5	28	2570
75	47.5	30	2280
115	52.5	32	2660
155	55.0	30	2640
185	52.5	29	2440
240	60.0	29	2700

SAMPLE NO. 2

TABLE NO. 5

Sample (2)	T=100°C.	t=60 min.	E_u=2240 ft lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	6.0	35	336
15	8.5	35	476
30	8.0	35	447
60	8.0	35	447
95	9.5	35	532

TABLE NO. 6

Sample (2)	T=200°C.	t=60 min.	E_u=2240 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	6.5	36	374
15	20.0	35	1120
30	30.5	34	1660
60	35.5	32	1815
90	38.0	32	1945
120	37.0	32	1900

SAMPLE NO. 3

TABLE NO. 7

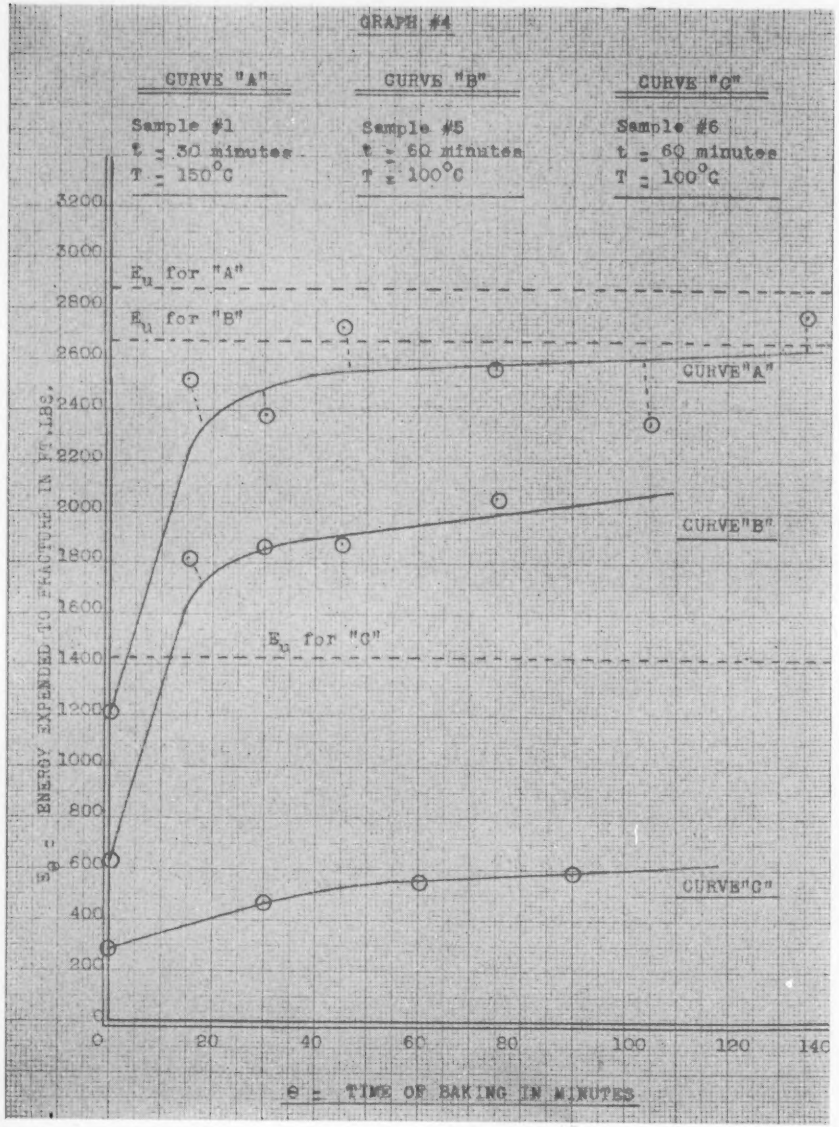
Sample (3)	T=100°C.	t=30 min.	E_u=2620 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	24.0	28	1075
15	41.0	27	1775
30	41.0	27	1775
45	45.0	27.5	1990
90	47.0	27.5	2070

TABLE NO. 8

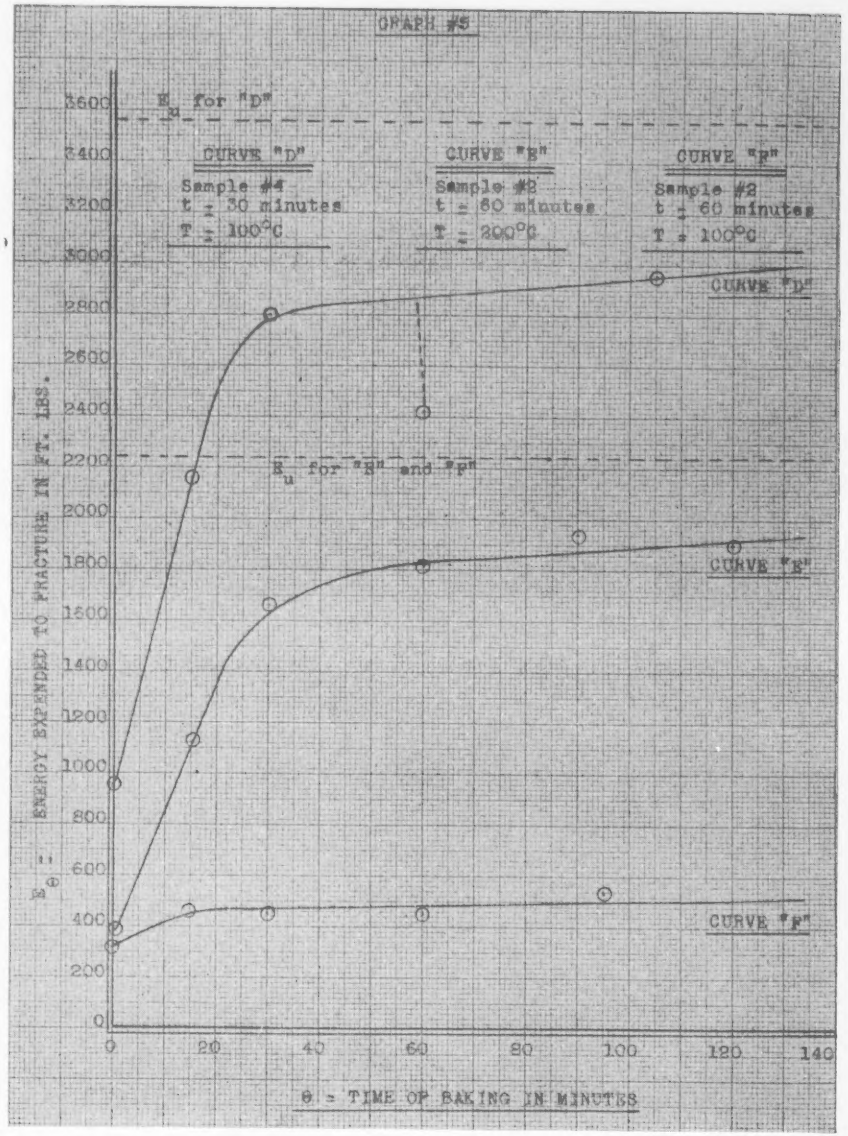
Sample (3)	T=200°C.	t=30 min.	E_u=2620 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	35.0	27	1510
15	53.0	27	2290
30	48.5	27	2100
60	54.0	27	2340
90	56.0	26	2330
120	56.0	28	2500

Part (7)
Discussion and Interpretation of the Results

THE results of the trials performed on the low carbon rivet steel, sample (1), make apparent the fact that the recovery of this steel from brittleness divides itself into two distinct stages. First we have a rapid, constant rate of recovery period which extends up to a critical point; the steel then reaches a slow recovery range, which extends from the critical point up to the final, normal value of toughness of the sample. The inaccuracy of the apparatus prevents definite statement as to whether the rate in this range is constant or not; the indication is,



Graph No. 4.



Graph No. 5.

SAMPLE NO 4
TABLE NO. 9

Sample (4)	T=100°C.	t=30 min.	E_u=3560 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	20	30	960
15	50	27	2160
30	78	22.5	2810
60	66	23	2420
105	84	22	2960

SAMPLE NO. 1
TABLE NO. 10

Sample (1)	T=150°C.	t=30 min.	E_u=2880 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	21	36	1210
15	49	32	2520
30	46.5	32	2380
45	55	31	2720
75	50	32	2560
105	43	34	2340
135	55.5	31	2770

SAMPLE NO. 5
TABLE NO. 12

Sample (5)	T=100°C.	t=60 min.	E_u=2650 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	11.0	37.0	652
15	31.0	36.5	1810
30	32.0	36.5	1870
45	33.5	35.0	1875
75	38.0	34.0	2060

SAMPLE NO. 6
TABLE NO. 11

Sample (6)	T=100°C.	t=60 min.	E_u=1455 ft. lbs.
θ Minutes	Bends	Average Bending Effort lbs. ft.	Eθ ft. lbs.
0	5.0	36.5	291
30	8.1	36.0	468
60	9.6	36.0	550
90	10.1	36.0	582

however, that the rate probably varies in this latter range. In view of the fact that this range is apparently uneconomical and is commercially impracticable, except in very special cases, it was deemed expedient to confine considerations to the rapid rate or practical range.

ULTIMATE VALUES
TABLE NO. 13

Ultimate values			
Sample No.	Bends	Average Bending Effort lbs. ft.	E_u ft. lbs.
1	64.0	28.0	2880
2	44.0	32.0	2240
3	63.0	26.0	2620
4	99.0	22.5	3560
5	45.1	37.0	2650
6	26.0	33.5	1455

✦ ✦ ✦

IT is seen that this steel experiences considerable recovery of toughness even at low temperatures, and from graph No. 3 we see that the rate of recovery is a linear function of the temperature of baking; this function has been evaluated and is given on that plot. However, the critical energy loss is not a linear function of the temperature, but follows a logarithmic law, which has been evaluated on graph No. 2. The result of decreasing the time of pickling, with this steel, indicates that this factor has very little effect on the recovery, except that the initial value of toughness is slightly higher, but is still in the rapid recovery range even when the pickling time is reduced to a minimum.

✦ ✦ ✦

FROM curve (D), graph No. 5, it is seen that the physical state of the steel has little effect on the recovery, as both the rate and the critical energy loss of an annealed sample are only slightly lower than the similar values for the work hardened, cold drawn specimen. This is, however, contrary to the generally acknowledged fact that the harder the steel the slower the recovery. The aberration from this may be explained by the fact that we are dealing with a $\frac{3}{8}$ inch specimen which has, after coming from the hot rolls, suffered merely a 40% reduction in area in the cold drawing, and has thus not been subjected to much cold work. The increase in toughness by annealing is only of the order of 20%. Hence, the effect of cold work may not be apparent if such low values of it are being dealt with. There must also be taken into account the inaccuracy of the testing machine, which is met with during the investigation of very "leathery" materials. Curve (D) illustrates this and the curve drawn may well be in error, as the points are very erratic.

✦ ✦ ✦

THE same general principles apply to the high sulphur, high manganese steel, sample (2), curve (E) and (F), graph No. 5. However, no appreciable recovery can be effected at low temperatures for this type of steel, while at a temperature of 200°C, the steel follows dehydrogenation almost identical with that of the rivet steel.

✦ ✦ ✦

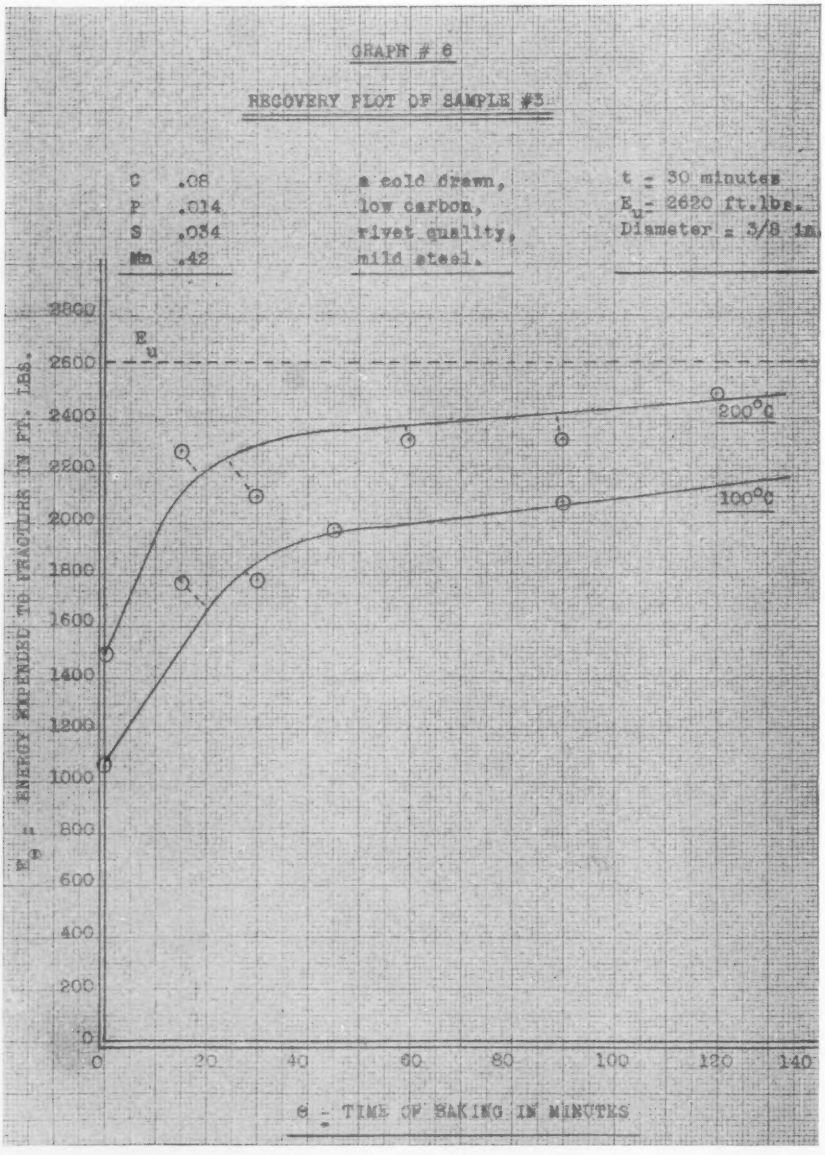
TO discover whether this effect was due to the manganese alone, the higher manganese rivet steel, sample (3), was investigated. The results plotted in graph No. 6 indicate that this presumption was false, as the steel recovered its toughness appreciably at 100°C and the rate was very similar to that of the low manganese steel, sample (1). Hence we are led to assume that the poor recovery of sample (2) at low temperatures was due either to the high sulphur alone, or to the combination of the high sulphur and the high manganese content.

AT first sight the results obtained for the medium carbon steel, sample (5), seem to disagree with the general principle that the higher the carbon content of the steel the less the recovery of toughness it will experience on baking. We are, nevertheless, neglecting in our comparison the fact that curve (B), graph No. 4, deals with a sample of $\frac{5}{16}$ inch diameter, while all the previous samples were of $\frac{3}{8}$ inch diameter. Hence the effective thickness through which the hydrogen must diffuse is less and the rate of diffusion is necessarily higher. Thus we have two opposing factors influencing the recovery; the smaller diameter tending to increase the recovery and the higher carbon content tending to decrease the recovery. In this case it may be assumed that these two factors balanced and the critical energy loss remained substantially the same as for low carbon steels.

✦ ✦ ✦

THE retarding effect of carbon on the recovery of steels is verified by the results obtained for the drill rod, sample (6). Here, although we are dealing with the same size of specimen as in sample (5), the critical energy loss is increased greatly. Thus, one may assume that the retardation of recovery was due to the higher carbon content alone, although insufficient data regarding the chemical composition of this steel, leaves this latter conclusion open to criticism.

✦ ✦ ✦



Graph No. 6.

Part (8)

Conclusions

FROM the preceding results, it may be concluded that steels experiencing recovery of toughness, after an induced acid embrittlement, do so in the following manner:

(1) In the first place there is a rapid constant rate of recovery, which extends up to a critical or commercially feasible point.

(2) The above is followed by a very slow rate of recovery range, which is relatively uneconomical, except in special cases where the quality of the product desired necessitates complete dehydrogenation.

(3) For a given steel the rate of recovery, in the commercial range, is a linear function of the temperature, and may be expressed thus:

$$\frac{dE}{d\theta} = k = a\,(T - b) \text{ ft lbs/hr.}$$

where a and b are constants.

(4) The critical energy loss, for a given steel, may be expressed as:

$$\log E_c = c - gT$$

where c and g are constants.

(5) Generally, low carbon steels can be effectively or at least sufficiently recovered from embrittlement for ordinary purposes by baking at 100°C; there are, however, exceptions to this rule.

(6) Varying the manganese content in low carbon steels has no perceptible effect on the recovery.

(7) High sulphur, high manganese contents in a low carbon steel make 100°C baking commercially uneconomical. At 200°C, however, these steels may be efficiently baked.

(8) Small amounts of cold work have very little effect on the recovery of toughness of a steel.

(9) It has been confirmed that the higher the carbon content of a steel the less the recovery on baking.

(10) The indication is that the rate of recovery of steel from acid brittleness varies with the diameter to a great extent.

(Please turn to page 160)

Industrial Trends Influence Changes In Three Magnet Wire Standards

By M. A. Kent,
Director of Manufacturing, General Cable Corp.,
Chairman Technical Committee on Magnet Wire, Sectional Committee on Specifications for Insulated Wires and Cables.

The revisions just approved by the American Standards Association in the standard specifications for magnet wire should make these three specifications more acceptable than ever before to manufacturers and purchasers of insulated wire, says M. A. Kent, General Cable Corporation, in this article. Mr. Kent is chairman of the Technical Committee on Magnet Wire of the ASA Sectional Committee on Specifications for Insulated Wires and Cables. The insulation requirements of these specifications codify the best experience in use and manufacture of insulated wire, Mr. Kent states, but the committee hopes that wide use of the specifications will bring in suggestions for new changes as experience indicates better practice. ✦ ✦ ✦ ✦

MAGNET wire to the layman is just one of many types of conductors of electricity used in our modern world today. All insulated wire used in winding magnetic coils whether they be separate coils or parts of generators or motors is known as magnet wire. To the engineer it is copper wire electrically insulated with enamel, silk, cotton, or paper, or a combination of these, and manufactured to very close physical dimensions. To the designing engineer of electric generators, motors, transformers, and instruments, it is the heart of all electrical equipment.

✦ ✦ ✦

MAGNET wire is as necessary and important to this Electric Age in which we live as oxygen is to life. It has worn this crown of importance since Michael Faraday discovered in 1821, and later perfected, the transformation of magnetic (electrical) energy into physical energy. Faraday tore into strips his wife's silk dress, wrapping the silk strips around the crude copper wire to provide the insulated wire (magnet wire) he needed.

✦ ✦ ✦

INSULATED wire now used in magnet windings of various kinds resembles the Faraday wire in fundamentals only. Thousands of different conditions of manufacture of electrical equipment, operation, and cost of this equipment must be met today. To accomplish this, magnet wires of a variety of sizes and combinations are available, ranging from enameled wire the diameter of a hair, to paper or cotton-insulated wire one-half inch in diameter. The space available for the windings, temperatures at which the apparatus will operate, atmospheric conditions, operating voltage, are all important factors in determining the type and amount of insulation used. An enamel coating gives high insulating values, together with relatively thin walls. A wrapping of silk insulation gives lower insulating values than enamel but affords reasonably thin walls. A wrapping of cotton gives approximately the same insulating values as silk but requires more space than either silk or enamel. Paper offers fair insulating qualities but necessitates considerably thicker insulating walls.

MOSS A. KENT

Director of Manufacturing of General Cable Corporation. Chairman, Technical Committee on Magnet Wire Sectional Committee on Specifications for Insulated Wires and Cables. Director of the Wire Association.

✦ ✦ ✦

ALTHOUGH these many variations are required to meet all conditions, most kinds of magnet wire fall into three general types—enameled, cotton and silk-insulated. Material specifications have, therefore, been formulated and are being used for these three types.

✦ ✦ ✦

THE first general industry specifications covering these three types of wires were drafted by a committee of the American Society for Testing Materials during the middle twenties and were adopted in December, 1927, as the industry standards by the American Institute of Electrical Engineers. In 1928 they were approved as standards by the American Standards Association.

✦ ✦ ✦

New Requirements

REALIZING that the art of manufacturing magnet wires had progressed, and that mass production of motors and generators had introduced additional requirements in magnet wires, the Magnet Wire Committee for the ASA Sectional Committee on Insulated Wires and Cables (C8) recently recommended revisions and addi-

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tions to these three specifications. The revised specifications have been approved by the ASA and are published as:

Specification for Cotton Covered Round Copper Magnet Wire—C8.5-1936
Specification for Silk Covered Round Copper Magnet Wire—C8.6-1936
Specification for Enameled Round Copper Magnet Wire—C8.7-1936

✦ ✦ ✦

IT is recognized that no specification can be the last and final word on any product and this is particularly true with magnet wires. New insulating materials are being developed, changed technique in coil manufacturing is introducing new problems, and mass production is altering relative costs, all of which go to make for greater variety in magnet wires and more exacting requirements and greater uniformity. However, these latest specifications should cover at least 75 per cent of the requirements of manufacturers of electrical equipment. They should guide the manufacturer and user of magnet wires to a common understanding of the other's requirements and limitations; and should guarantee, when used as manufacturing and purchasing specifications, a uniformly satisfactory product not only from the standpoint of physical characteristics but also from the standpoint of usability and satisfactory service in operation.

✦ ✦ ✦

Watches Trend

THE Magnet Wire Committee aims to observe closely the trend and developments in industry which may make advisable further revision of these specifications and the drafting of new specifications for magnet wires of types other than those covered in these three. This committee urges the use of these specifications wherever possible by manufacturers and purchasers of magnet wire in all fields. If these specifications do not cover the special requirements of individual users of magnet wire, it is suggested that they be amplified by the addition of paragraphs covering the individual purchaser's requirements. In this way the specifications will be more generally used by the industry with greater benefit to both manufacturer and purchaser.

IN order that the committee may build up its file for use in future revisions, constructive criticism and suggestions on any of these three specifications will be greatly appreciated.

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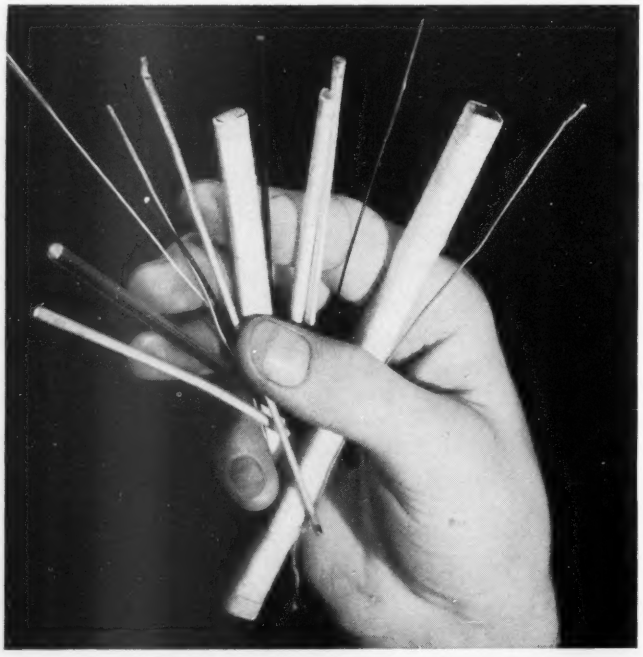
IN the specifications for Cotton Covered Round Magnet Wire (C8.5-1936) the principal changes, other than re-arrangement and editorial alterations, consist of a regrouping of sizes between No. 22 and No. 35 AWG. Heretofore these were grouped together, whereas in this revised specification they are broken into two groups, sizes No. 22 to 24 AWG in one group and sizes No. 25 to No. 35 AWG in the other group. There has been added a paragraph on hardness of insulated copper wire after the removal of the insulation. The hardness is controlled by elongation limitations. It is recognized that elongation does give a fair indication of the true hardness of the wire but that it does not indicate the relative windability; that is, "springiness" or resistance to bending, which it is hoped will be accomplished by some sort of a "springiness" test.

SEVERAL of the manufacturers and users of magnet wire are cooperating with us by carrying on experiments on test equipment designed to give a true indication of windability of magnet wire. It will take another year or two to develop adequate, reliable information which will enable the writing of a specification covering this factor. It was the long time required to secure reliable information that forced the use of the elongation test in these present specifications. The committee recognized that the elongation test did not give all that was desirable but felt that it was the best and most reliable test available at the present time.

✦ ✦ ✦

IN the specification for Silk Covered Round Copper Magnet Wire (C8.6-1036), changes similar to those just discussed have been made. In addition to these the minimum permissible addition to the diameter of the bare wire by the insulation has been decreased from 75 per cent to 60 per cent of the measured maximum. This was done because of the unavoidable variation in the diameter of natural silks available for the insulation of these wires.



The heart of all electrical equipment—insulated copper wire. Enamel, silk, cotton, or paper, or a combination of these materials, are used to insulate the wire. New developments in manufacture of this "magnet wire" make changes in the standards essential. ✦ ✦ ✦ ✦ ✦ ✦

Practically, this change means little to the user. Under the old requirement it was sometimes impossible in manufacture to adhere strictly to the specifications even with the use of the best quality commercial silk.

✦ ✦ ✦

Most Changes for Enameled Wire

THE greatest number of changes have been made in the specification for Standard Enameled Round Copper Magnet Wire (C8.7-1936). A general rearrangement of the specification has been made, but probably the most important change has been the far better graduation of insulation thickness requirements than was found in the old specification. Each American Wire gauge size covered by the specification is listed and its minimum and maximum addition of enamel coating given in Table I.

✦ ✦ ✦

TO bring the paragraph covering flexibility of enamel more in line with the present commercial practice, the diameter of the mandrels, around which the enameled wire must successfully bend, have been reduced approximately 25 per cent from the previous requirements.

✦ ✦ ✦

RE-GROUPING and other slight changes in the requirements covering softening of the enamel upon heating have been made. The electrical test requirements have been increased and a general regrouping of the sizes gives a much more uniform electrical test in terms of volts per mil of insulation thickness. There has been added an additional electrical test called "twist test" which specifies definite voltage breakdown between two insulated twisted wires. This test was put in because similar tests are used quite generally by certain groups of purchasers.

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THERE was added a continuity test to control the uniformity and continuity of the enamel coating. To this specification has also been added the hardness test explained previously.

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WITH these changes the three specifications should be more acceptable to a larger group of manufacturers and purchasers of magnet wires than were the previous specifications.

✦ ✦ ✦

OUR committee hopes information secured from the use of these specifications by both purchasers and manufacturers of magnet wire will enable it, in the next year or two, to again revise the specifications so that they will be still more acceptable and generally usable to the industry.

✦ ✦ ✦

Experts on the Technical Committee who were responsible for preparing the revised specifications on magnet wire are:
M. A. Kent, General Cable Corporation, Chairman
F. W. Andrew, Consulting Engineer
E. W. Clark, General Electric Company
R. H. Dagleish, Capitol Traction Company
E. H. Hammond, American Electrical Works
Dean Harvey, Westinghouse Electric & Manufacturing Company
T. M. Hunter, American Transformer Company
F. B. Hynes, Crocker-Wheeler Elec. Mfg. Company
T. S. Johnson, Anaconda Wire & Cable Company
Kenneth MacKay, Acme Wire Company

The Performance of Unionism In Heavy Industry

COLLECTIVE bargaining in important heavy industries failed to increase either employment opportunity or labor purchasing power during the prosperous period ending in 1929, point out the two prominent business economists, Allen W. Rucker and N. W. Pickering, in their latest study of employment and wage conditions in industry. "In the rising period of prosperity ending in 1929, none of the six union industries studied increased purchasing power more than 2.5% over 1923, as compared with 11.8% average increase in all manufacturing. In that same period, these six union industries accounted for a total loss of employment opportunity which reached the impressive figure of 637,696 fewer jobs than in 1923."

✦ ✦ ✦

THE study includes Anthracite and Bituminous Coal Mining, Glass Manufacturing, Railway Repair Shops, Railway Transportation and Ship-building. The data, covering both the prosperity era 1923-1929 and the depression era 1929-1933, have been released in booklet form by Farrel-Birmingham Company, Inc., Ansonia, Conn. and Buffalo, N. Y.

✦ ✦ ✦

"TOTAL employment opportunity," say the authors, "was markedly less at the end of the period of rising prosperity than it was at the beginning in 1923, the total shrinkage of jobs reaching 637,696 by 1929 in these six industries alone. Purchasing power increases were nominal in three instances and showed serious declines in three instances, notably Anthracite and Bituminous Coal Mining and Railway Repair Shops, all strongly unionized.

✦ ✦ ✦

"IN the depression period, none of the industries studied maintained employment opportunity as well as the average in all manufacturing, and only two sustained labor's aggregate purchasing power better than the general manufacturing average. The heaviest declines in purchasing power occurred in Anthracite and Bituminous Coal Mining, the indices of which dropped respectively to 48.9% and 33.9% of the 1923 level.

✦ ✦ ✦

"THE performance of unionism in these heavy industries when viewed in the combined light of total employment opportunity and total purchasing power generated in boom and depression periods, compels the conclusion that the end results do not confirm the claims made for unionization. There is, instead, ample ground for labor as a whole to thoroughly distrust unionism and the entire theory of wage and hour regulation borrowed from feudal European philosophy."

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J. W. Rockefeller, Jr., Section Editor.

Vol. 12 MARCH, 1937 No. 3

The Effect of Longitudinal Scratches Upon The Endurance Limit in Torsion of Spring Wire

PART I

By F. P. Zimmerli

Chief Engineer, Barnes-Gibson-Raymond, Inc., Detroit, Mich.

The following abstract includes only the bibliography referred to in the abstract and does not include the work of other investigators. This digest will be published in two parts. ✦ ✦

Introduction

THIS report covers an investigation which has been carried out to ascertain the effects of longitudinal scratches upon the endurance limit in torsion of steel wire used in the production of helical springs. Although the investigation cannot be considered to have been completed, this serves as a final report since it has become necessary to discontinue the work. There was in the original complete report a review of the work of other investigators, descriptions of the material and apparatus used, a statement of the results obtained and a discussion of the possible application of the results.

Abstract of a report by the Research Department of the Associated Spring Manufacturers compiled under the direction of the author. It is also desired to acknowledge the cooperative service rendered by the Barnes-Gibson-Raymond laboratories in connection with the necessary laboratory work done to tabulate the results secured.

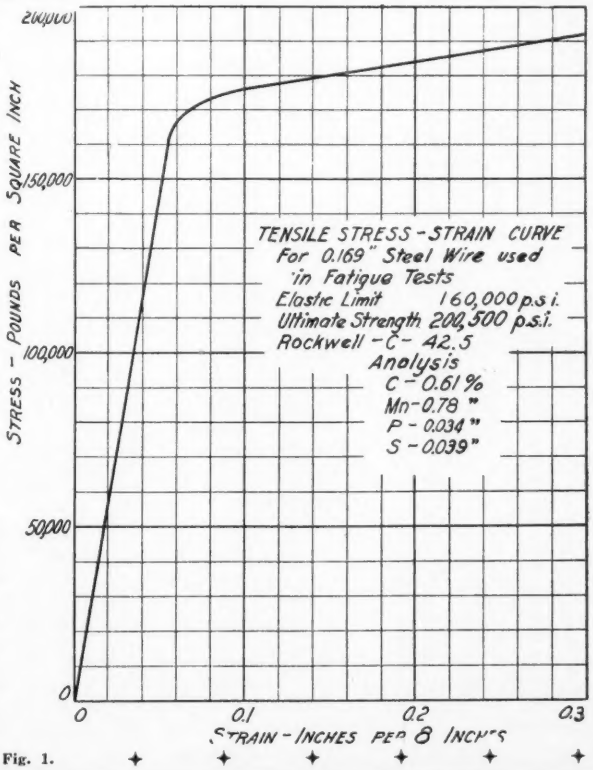

Fig. 1. ✦ ✦ ✦ ✦ ✦ ✦

LONGITUDINAL scratches may appear on the wire as it comes from the wire mill or may be produced during the operation of coiling. It is also possible for incidental scratches to appear as a result of careless handling and other causes. The question is always in mind, what is the effect of depth and contour of the scratch upon working stresses in the springs. In other words, is there any limiting size or shape of scratch which may be considered relatively harmless as far as the performance of helical springs is concerned.

✦ ✦ ✦

NO inspection method has been developed, as far as could be ascertained, which enables the spring manufacturers to predict with any certainty the effect of a given scratch upon the fatigue properties of the wire. It was the aim of this investigation to first develop a method for accurately measuring the

Announcing A Development In Editorial Policy - - -

✦ ✦ ✦ SPRINGS AND WIRE PRODUCTS ✦ ✦ ✦

J. W. ROCKEFELLER, JR.
Consulting Engineer
Editor
Springs and Wire Products
Department.

Graduated from Massachusetts Institute of Technology 1921. 1921-1928, John Chatillon and Sons, New York, N. Y., from which resigned as Works Manager to enter consulting field. Has been engaged in installation of spring plants and design and production of wire springs for firms in spring, spring balance, and automotive fields. Charts for calculation of helical springs, translated into Kilo-Cm basis and adopted by Italian Engineering Standards Committee, 1926. Secretary of Spring Research Committee of American Society of Mechanical Engineers for five years and during that time representative of American Society for Steel Treating on that committee.

✦ ✦ ✦

WITH this issue, WIRE & WIRE PRODUCTS inaugurates a new department, which it is hoped will make the publication of greater interest to the producers and users of both Wire and Wire Products. This Department, which will be known as the Springs and Wire Products section, will be a permanent feature and through it, WIRE & WIRE PRODUCTS will make an earnest effort to keep those readers, whose interests are in this field, in touch with the latest news and technical developments.

✦ ✦ ✦

UNDER the editorial and engineering direction of J. W. Rockefeller, Jr., well known consulting engineer on spring problems, during the coming year, we expect to include original articles on the subject of Springs and Wire Products, together with news of the activities of Engineering Committees, both here and abroad, which promote research in this field, a bibliography of current Spring and Wire Products literature and trade news of general interest to those in any way connected with the industry.

✦ ✦ ✦

JUDGING from expressions of opinion that we have received from time to time, there appears to exist in the publication field, a place for such a department as we hope to create. We have been assured of the cooperation of a number of firms and individuals whose chief interests lie in the field which we shall attempt to cover. We shall make every endeavor to enlist the aid of additional individuals and firms of this type, with the ultimate aim of making this department a clearing house for spring and wire product news and information.

✦ ✦ ✦

SUGGESTIONS for making this department of the greatest use to those it is designed to serve will always be welcome, and the general editorial content will at all times be subject to modification which will make it more nearly conform to their needs and desires.

depth and contour of scratches, and secondly, to determine the effects of scratches, with varying depths and contours upon the endurance limit in torsion of a typical spring wire. The ultimate result of such an investigation would be expected to provide the spring manufacturer with information by which he might be able to predict the performance of helical springs with various types of scratches upon their surface.

✦ ✦ ✦

Description of Steel Investigated

THE steel used in this investigation was a high grade acid open-hearth valve spring wire. The chemical and physical properties of this wire are given in Figures 1, 2, and 3. It is a tempered wire produced in the United States and was not specially manufactured, since it was taken from stock in a spring plant. Microscopical examination showed the wire to be free from seams and non-metallic inclusions. The diameter of the wire was approximately 0.169 inch. Torsion tests were made on this material turned down to 0.110 inch which was the diameter of the reduced part of the torsional fatigue test specimen. It will be noted from Figure 3 that there is no appreciable difference in the static torsional properties at this diameter and at the full diameter of the wire.

✦ ✦ ✦

Procedure

Preparation of Test Specimens

SPECIMENS for torsional fatigue tests were prepared from the wire described. A drawing of one of these test specimens is shown in Figure 5. The reduced section is 0.110 inch diameter for a length of 0.125 inch. The ends are ground to a square cross section approximately 0.134 inch on a side.

Fig. 5.

✦ ✦ ✦

ALL test specimens were polished in a lathe with strips of emery paper. The grades of emery paper used were 0, 00, and 000. Finer paper was not used, since the work of H. F. Moore (21) shows no appreciable gain in endurance limit with more highly polished test specimens.

✦ ✦ ✦

THE diameter of the test specimens was then carefully measured with pointed micrometers to within 0.0005 inch. This diameter, which was used for calculating stresses, was the diameter at the smallest part of the reduced section of the test specimen. If the specimen was slightly out-of-round, the smallest diameter was also used.

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THE next operation was that of making scratches upon the re-

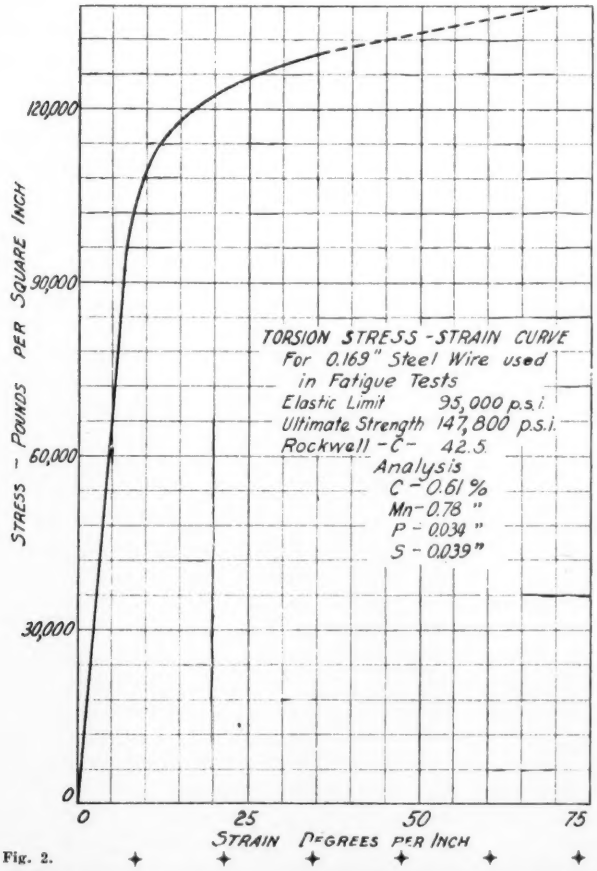

Fig. 2.

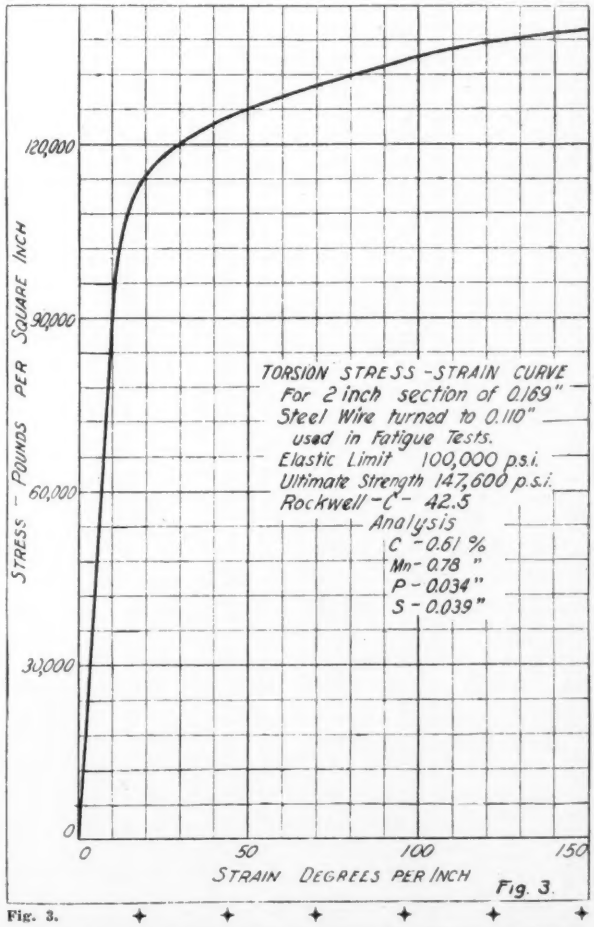

Fig. 3.

duced section of the test specimen. A blue dye was first applied to this part of the specimen in order to make it easier to locate the point at which the tool started to make a scratch. The specimen was then clamped on the stage of the device for producing scratches. In the case of high speed steel or Stellite tools the edge of the tool was honed as sharp as possible before starting to make the scratch. The tool was then inserted in the tool holder and the scratch made by moving the stage and specimen back and forth under the point of the tool. In making all scratches a cut of 0.00025 inch was used. After every four cuts or every 0.001 inch the tool was allowed to ride along the entire length of the reduced section. This was done to prevent the scratch from ending too abruptly. If this was not done, the specimen would usually fail at the end of the scratch rather than at the middle of it. In all cases the length of the scratch proper was approximately 0.125 inch. After the scratch was completed the test specimen was removed from the stage and the blue dye was taken off with a cloth saturated with alcohol. The test specimens were then ready for the fatigue tests.

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BEFORE a test could be made upon a specimen the angle of twist for the specimen had to be determined. This angle, of course, was determined by the stress which was to be produced in the test specimen. These endurance tests were all made with stress cycles of zero stress to a maximum stress, since it was believed that this cycle would more closely approach the service conditions present in a helical spring than would an alternating stress cycle. It was necessary then to stress a test specimen to the desired stress and measure the angle of twist required to produce this stress. If the fatigue machine was then set to this angle of twist, the desired stress in the test specimen would be reached when the machine was in operation. The first operation, therefore, was to determine the angle of twist which would give the desired stress in the test specimen.

THE test specimen was inserted in the fatigue machine and clamped in the grips. It was then necessary to calculate the twisting moment required to produce the stress desired in the test specimen. The stress present in a cylindrical rod under a twisting moment is given by the formula:

$$S = \frac{16PR}{\pi d^3}$$

where

S = stress in the outer fiber in pounds per square inch.

PR = twisting moment in inch-pounds.

or

P = load in pounds.

R = length of lever arm in inches.

d = diameter of the rod in inches.

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THE twisting moment required to produce any given stress in the test specimen could be calculated, since the diameter of the specimen was known. When the angle of twist corresponding to a given stress was determined in the fatigue machine, the twisting moment was produced by weights acting on the cable and pulley attached to the shaft of the fixed jaw. If the radius of the pulley and the thickness of the cable are known, it is possible to calculate the lever arm through which the weights act. This is, of course, equal to the radius of the pulley plus one-half the thickness of the cable. After the length of the lever arm has been determined the load required on the cable to produce the twisting moment desired can be calculated. The weight of the cable was found to be so small that it could be disregarded. It was possible, therefore, to place a definite weight upon the cable and produce the stress desired in the test specimen. The next operation was the measurement of the angle of twist corresponding to the stress range through which the specimen was to be tested.

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THE angle of twist was measured by a system consisting of a mirror mounted on the fixed jaw shaft of the fatigue machine and a telescope and scale located a few feet from the mirror. The mirror was mounted on the shaft in such a manner that it rotated with the shaft about its axis. Thus the rotation of the fixed jaw and shaft caused by a dead load on the cable produced a corresponding and equal rotation of the mirror. The scale, as mentioned above, was mounted on the telescope. It was then possible to focus the telescope on the scale as reflected from the mirror. Since there were cross hairs in the telescope, it was possible to obtain a reading on the scale for any given position of the mirror. This held true, of course, for any position of the mirror within the limits set up by the length of the scale. The scale was 34.5 cm. long and was placed at a distance of 69 inches from the mirror. This arrangement gives the same results as a pointer 69 inches long attached to the fixed jaw shaft. It was possible to measure the angle of twist corresponding to a given stress very accurately in this manner. A load was applied to the cable and pulley to produce the stress desired in the test specimen. A reading of the telescope was then taken. The load was removed and a second reading taken. The first reading minus the second reading gives a value in centimeters which is a measure of the angle of twist. It was not essential that the value be expressed in terms of radians or degrees, since the angle of twist to which the fatigue machine is set may also be measured on the scale in terms of centimeters. On the average fatigue test specimen the accuracy of this method for measuring angles of twist is about ± 0.3 per cent. The smallest angle that can be measured in this manner with the equipment used as described is approximately 0.016 degree or .96 minute.

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THE twist of the fatigue machine was set at the value of the angle of twist which had been determined by static loads. The loads were measured on Chatillon scales which were accurate to about $\pm .15$ ounces or approximately ± 0.1 per cent. The two dead center positions of the crank of the fatigue machine were found by using an indicator on the movable jaw. The angle through which this jaw turns while the crank moves from one dead center to the other is the

angle of twist for the fatigue machine and must equal the angle of twist experimentally determined for the test specimen. The angle of twist of the machine was generally varied by changing the position of the small end of the connecting rod on the slotted rod. When such procedure did not give a sufficient range of adjustment the relative position of the two eccentrics was changed. By means of these adjustments it was possible to vary the angle of twist from zero to the maximum provided for by the design of the fatigue machine.

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PRELIMINARY tests showed that the fatigue test specimens invariably suffered a permanent angular deformation or set shortly after the fatigue tests were started. The same phenomenon was observed by **Swan, Sutton, and Douglas** (34). The amount of set was measured as follows: The crank of the fatigue machine was set at the position where no stress should be present in the test specimen. This position was at one of the dead centers of the crank, since the fatigue tests were made with a stress range of zero stress to a maximum stress. The position of the fixed jaw was then read by means of the mirror, telescope, and scale. The jaw was next unclamped, which allowed it to come to a position where no stress was present in the test specimen, and a second reading taken. The difference between the two readings represented the amount of permanent angular deformation of the test specimen. This behavior of the test specimen changed the stress cycle of the fatigue test, since it changed the stress range from one of zero to a maximum stress to one which started with a fairly small negative stress, and passed through a zero stress position to a higher positive stress. For example, if the original stress range was zero to 100,000 pounds per square inch, after the test specimen had undergone a permanent deformation the stress range might have changed by such behavoir to −15,000 to + 85,000 pounds per square inch.

IN order to allow for the twist taken by the test specimen an initial twist, which produced an initial positive stress, was applied to it before the fatigue test was started. This twist amounted to 5 to 25 per cent the angle of twist determined by static loads, and varied according to the stress ranges used in the fatigue test. Thus for high stress ranges the initial twist was about 25 per cent the angle of twist, while for the lower stress ranges it was sometimes as little as 5 per cent. The initial twist was applied by dead loads and was measured in the same manner as the angle of twist corresponding to the stress range. The fatigue machines were ready to start after the application of the initial twist. The stress range was changed by the procedure described as follows: If at the start of the test, the stress range was + 15,000 to + 115,000 pounds per square inch, after the test specimen had been angularly deformed, the stress range would be approximately 0 to 100,000 pounds per square inch. Preliminary work showed that the amount of permanent twist or deformation present in the test specimen was directly proportional to the stress range of the test. It also indicated that such permanent twist occurred during the first few hours of the test. After this period the stress cycle would remain constant, provided that allowance was made for the permanent twist in the early stages of the test.

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THE fatigue machines were, therefore, started and allowed to run for several hours after the initial twist had been applied to the test specimen. The machines were then stopped and the cranks set at the zero stress positions by means of the indicator previously described. Readings of the position of the fixed jaw both before and after the clamp was loosened were obtained with the mirror and telescope. If the difference between the first and second readings was negative, the test specimen had deformed more than had been anticipated. In this case an additional twist was applied to the test specimen. If the difference between the two readings was positive, the deformation of the test specimen was not as great as had been expected. If the two readings were identical, the deformation had been estimated correctly. In the last two cases there was no need to apply additional twist to the test specimen, and the fixed jaw was therefore clamped at the zero stress position. This procedure was repeated until no further deformation in the test specimens was noticed. In no case did it have to be repeated more than twice, unless as a precaution to make sure that the stress cycle had not changed. As mentioned previously, after the first few hours of the test the stress cycle did not change appreciably. This was found to be true by repeating the above procedure at the completion of the test in cases where the test specimen did not fail.

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THREE specimens were tested at each stress for every type of scratch. The failure of two out of three specimens determined that the stress was above the endurance limit of the specimen. If two of the three specimens did not fail, it was concluded that the maximum stress was below the endurance limit.

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Measurement of Scratches

THE tools used for making scratches were made either of high speed steel, Stellite or diamond. The angles of the high speed tools were 15, 30, and 45°. The Stellite tool had an angle of 30° as did the diamond tool. Although these tools were made with definite included angles as stated, this gave no indication as to what the shape of the scratches made by the tools would be, since every time a scratch was made a certain amount of the point would be worn away and the resulting shape might be much different than it was before the scratch was made. For the same reason no accurate idea could be formed of the depth of the scratch even though the tool was fed a definite distance in toward the test specimen. For this

reason it seemed essential to devise a method for determining accurately the shape and depth of scratches formed by the various tools.

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THE first method tried was that of **Thomas** (9) in which impressions were made by means of gelatine casts. Difficulty was encountered, however, in making casts and removing them from the small test specimens. Subsequent work by Kiesewetter (12) also showed that other substances are more satisfactory than gelatine for making impressions of very fine scratches.

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THE **"wigglecator"** as developed by **Firestone, Durbin, and Abbott** (13) was then used in an attempt to measure the scratches. Sewing needle points were used as tracer points. The results obtained were not satisfactory for several reasons. The tracer point had a tendency to become caught in the scratch and also did not enter the scratch smoothly. For these reasons it was impossible to determine the shape of the scratch with this apparatus. In some instances it was possible to measure the depth of the scratch with the wigglecator. For rather wide and shallow scratches depth measurements were quite satisfactory. On sharper scratches, the tracer point was not fine enough to fall to the bottom of the scratch. Thus depth measurements on such scratches gave low values when made by the wigglecator. For these reasons the use of this apparatus was discontinued.

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THE method finally used to measure the shape and depth of scratches was similar to the one used by **Sawyer** (10) in determining the roughness of ground or machined surfaces. The procedure was as follows.

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THE test specimen was cut in two about 0.06 inch from the point at which it was desired to examine the scratch. The piece of the test specimen thus made was heavily plated with copper. The thickness of the copper plate was not less than 0.02 inch. The piece was then mounted vertically in a steel ring with Wood's metal in such a manner that, when ground and polished, a cross-section of the test specimen and scratch would be obtained. About 0.06 inch was then ground off of the test specimen and ring. This brought the point at which the scratch was to be examined very near the ground surface. The piece was then taken down successively on No. 1 emery paper, 0 emery paper and graphite, 00 emery paper and graphite, and 000 emery paper and graphite. It was then polished with coarse rouge on billiard cloth using water as a lubricant and was finally finished with fine jewelers' rouge on billiard cloth lubricated with water. The highly polished specimen could then be examined with a microscope. Very accurate profiles of the scratches could be made in this manner. Photomicrographs were made on five by seven inch plates of these scratches. The magnification used depended upon the size of the scratch. By means of these photomicrographs very accurate depth measurements could also be made. This same procedure was used to examine the scratches found on commercial spring wire.

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Summary

THE results of this investigation may be briefly summarized as follows:

1. Scratches may be measured accurately by plating the wire heavily with copper, polishing a cross section, and examining the scratch with a microscope.
2. Scratches on polished torsional fatigue test specimens lower the endurance limit of the material.
3. The decrease in endurance limit caused by a scratch on the test specimen varies directly with the depth of the scratch and inversely with the radius of curvature at the bottom of the scratch.
4. The decrease in endurance limit due to a scratch on the test specimen is much less than would be predicated by calculating the stress concentration at the bottom of the scratch.
5. The endurance limit of wire determined by fatigue tests on helical springs is only 60 to 65 per cent the endurance limit of the same wire in the form of polished torsional fatigue specimens. It is doubtful whether this difference is entirely due to the presence of surface scratches.

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PART II

Part II will be published in the April, 1937 issue of WIRE AND WIRE PRODUCTS. This will contain a discussion of the results together with microphotographs of the various tests made.

Bonderizing Now Applied to Springs of Many Types

BONDERIZING, for some time in use in the automotive industry for the rust-proofing of automobile bodies, has recently been further extended to protect knee-action springs against corrosion. These springs are subject to corrosion conditions produced not only by the elements, but by certain chemicals which are spread upon roads, either to melt ice or lay dust. The use of these chemicals has frequently been accompanied by an increase in fatigue failure of this type of spring and it has been found that some method of rust-proofing is highly desirable. After Bonderizing, these springs are usually finished with paint, enamel or lacquer.

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OTHER types of springs to which this process has been applied are safety valve springs and flat springs forming the clips of fountain pens, as well as such other wire products as lock washers and wire clips. The Bonderiz-

(*Please turn to page 154*)

ANNOUNCING ❖ ❖

The Organization of a New Division of the Wire Association Devoted to

COLD WORKING OF METALS FINISHED PRODUCTS

B. L. McCARTHY, Metallurgist,
Wickwire Spencer Steel Co., Buffalo, N. Y.
Chairman of Division

Organization and Membership Committee
A. R. ZAPP,
Firth Sterling Steel Co.
Chairman

✦ ✦ ✦

PURPOSES:

The specific purposes are to promote the art of cold working, together with the application of metallurgical and scientific studies to these and related problems and to improve the manufacturing processes of cold working, cold heading, deep drawing, sintered grinding, extruding, etc.

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FUNCTIONS:

THE division functions along the following lines:

1. The use of the Association headquarters as a central clearing house for information and data of all kinds which may be of interest to members.
2. The exchange of ideas on processes of production including machinery, technical processes, etc.
3. The establishment and maintenance of friendly relations among the members of the association and the development of sectional and national meetings to discuss matters of mutual interest.
4. Studies of production methods and analysis of production costs.
5. Developments in the use of new materials and new applications of existing materials and by-products.
6. Research and collection of information on personnel management, including such factors as labor turnover, seasonal changes in the demand for employees, wage scales, etc.
7. Standardization and simplification as a means for the effective elimination of waste.
8. Such other subjects as may be determined upon.

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ACTIVITIES:

DURING the year the following activities will be in operation:

1. Each month there will be published in WIRE AND WIRE PRODUCTS, the designated "Official Publication" of The Wire Association, at least two articles or research papers relating to the cold working of metals or the fabrication of cold headed or cold finished products made from cold drawn bars, rods or wire. These papers will be contributed by writers fully conversant with the subjects presented.
2. The Wire Association information service—A cooperative confidential service through which members exchange ideas and endeavor to aid each other in process and production problems. No identities are revealed without specific authorization. Questions and answers are given a number and all data transmitted under the allocated number.
3. The annual Wire Association technical meetings held annually in association with the National Metal Congress. At this convention each division of The Wire Association holds three sessions on non-conflicting dates as follows: 1. Metallurgy and Research. 2. Processes and Machinery of Production. 3. Cold Working and Cold Finished Products.

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THE ANNUAL DUES ARE $10.00

In addition to the activities set forth, the membership also includes:

1. A subscription for the period of the membership to the designated official publication of the Association, "WIRE AND WIRE PRODUCTS".
2. A copy of the annual WIRE BUYERS GUIDE AND YEAR BOOK OF THE WIRE ASSOCIATION.
3. Proceedings.

This is an Invitation For You to Join The Wire Association and Participate in the Activities of Your Division.

Simply Fill Out the Membership Form Shown and Mail it to

Richard E. Brown, Secretary,
The Wire Association
17 E. 42nd St., New York, N. Y.

THE WIRE ASSOCIATION
17 EAST 42ND STREET, NEW YORK, N. Y.

The undersigned hereby applies for membership in the Wire Association, and agrees to be governed by the Charter and By-Laws of the Society and to further its objects as laid down therein.

Name .....

Address .....

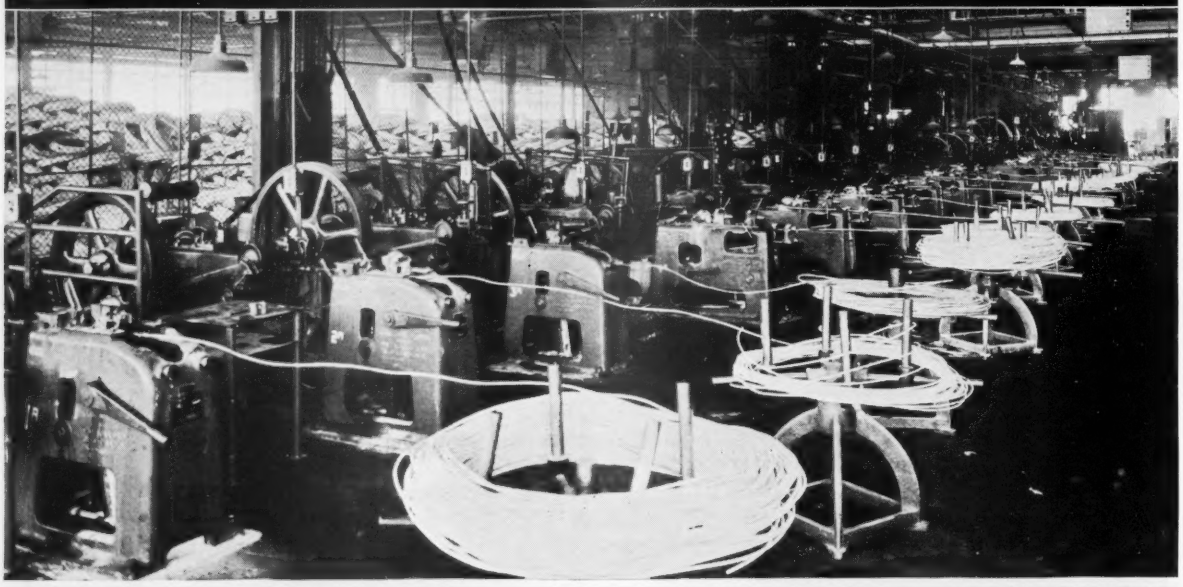
Applicant's Title or Occupation .....

Name of Organization .....

Address of Organization .....

Nature of Business .....

100% Equipped



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Since the introduction of the Ajax-Hogue Wire Drawer only two years ago, seven manufacturers of cold headed products have equipped their plants 100% with these new machines. Shown above is the installation of Acme Machine Products Division of the Serrick Corporation in Muncie, Indiana, where a total of 18 Ajax-Hogue Wire Drawers equips their cold header department 100%.

In all seven of these plants, the complete installation followed the purchase of a single unit, which proved beyond a doubt the profitable performance of this unique machine.

The Ajax-Hogue Wire Drawer cold draws and coats hot-rolled, pickled and limed stock as it feeds into the header, saving the differential in cost between the hot-rolled and the more expensive cold-drawn stock ordinarily used.

In addition, it greatly improves the quality and accuracy of the product and substantially increases die life due to easier heading immediately after drawing.

If you are a manufacturer of cold headed products, it will pay you to investigate the profit possibilities of this machine at once. We suggest that you write today for Bulletin No. 111 for complete details.

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COLD WORKING OF METALS FINISHED PRODUCTS

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1. Metallurgy and Research
2. Processes and Machinery of Production
3. Cold Heading
4. Cold Forming and Finishing Operations
5. Extruding

Vol. 12 MARCH, 1937 No. 3

High Tensile Cap Screws Made From Low Carbon Steel Cold Drawn At The Header

By F. W. Gaines III, M.E.

The Ajax Manufacturing Co., Cleveland, O.

Results of tests to determine the possibility of making high tensile un-heat treated bolts and cap screws through extrusion in header dies or controlled cold drawing just prior to heading.

DURING the past year there has has been a great deal of interest and discussion concerning the possibility of making high tensile, un-heat treated bolts and cap screws from a low carbon steel, and securing the improved physical properties through extrusion in the header dies or through controlled cold drawing just prior to heading.

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IN order to determine the practical possibilities of this latter method, a number of S A E 3/8"-24 x 1-5/8" cap screws were fabricated using S A E 1420 hot rolled, pickled and limed rod, which was cold drawn in the Ajax-Hogue Wire Drawer as the stock entered the header. The results reported in this article were compiled from data from tests on several hundred of these cap screws manufactured on an actual production basis.

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Wire Drawing Mechanism

BEFORE giving the results of the tensile tests on the finished caps screws, it is perhaps well to describe briefly this method of drawing, for the benefit of those who are not familiar with it. The drawer mechanism is attached to and operated from the cold header and cold draws and coats the hot rolled pickled and limed rod as it feeds into the heading machine.

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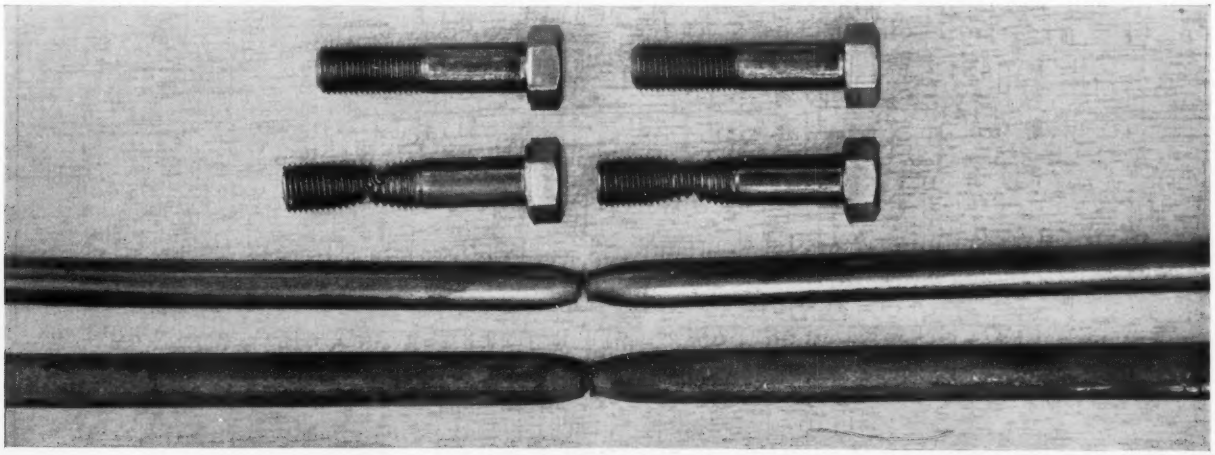
THE Wire Drawer is set directly in front of the header, with the drawing slide actuated by a vertical lever, fulcrumed in the drawer frame beneath the slide, which derives its motion through a long, horizontal connecting rod from a driving crank, mounted in



Hot rolled rod, fractured cap screws and finished cap screws made from Hog ue drawn wire. ✦ ✦ ✦ ✦ ✦ ✦

an independent housing at the back of the header and rigidly connected to the front drawer frame by spacer rods. The driving crank is driven by roller chain from a sprocket on the end of the header crankshaft, and the eccentric of the driving crank is adjustable to control the drawing stroke. The chain is the only operating connection between the wire drawer and the heading machine.

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DUE to the method of operation, drawing causes no appreciable increase in the duty on the header feed rolls, and since the drawing takes place during the period after cutting off and between the first and second heading strokes, there is no noticeable increase in the demand load on the header motor.

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Easy Operation

THE operation of the Ajax Wire Drawer is extremely simple. The coil of rod is started through the drawer by the "inching" feed mechanism used only for starting new coils. As soon as the stock reaches the header feed rolls, the "inching" feed is disconnected and the freshly drawn wire is fed intermittently into the header in the usual manner. During the period when the stock is stationary between feeds, the wire is held securely between grips in the wire drawer, and the drawing die is pushed back along the rod a distance equal to or slightly greater than the length of feed.

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WHEN the header feed cycle occurs, the grip releases and the drawing die and the slide which carries it are moved forward by the rod and are then pushed back again during the next stationary period.

The Drawing Compound

THE drawing compound, which coats the wire for lubrication in the header dies, is contained in a box shaped reservoir on the die slide of the drawer. This compound, may consist of a variety of mixtures, among the most satisfactory being aluminum palmitate and hydrated lime in proportions which can be varied by the operator to secure a wire coating best suited to the heading operation.

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Material Used for Tests

THE material used in making the cap screws for these tests was SAE 1420 hot rolled, unnormalized, pickled and limed rod. To secure the best tensile qualities, this rod was obtained with the carbon and manganese on the high side or approximately .20 carbon and .90 manganese, which is the general practice among manufacturers of cold headed products.

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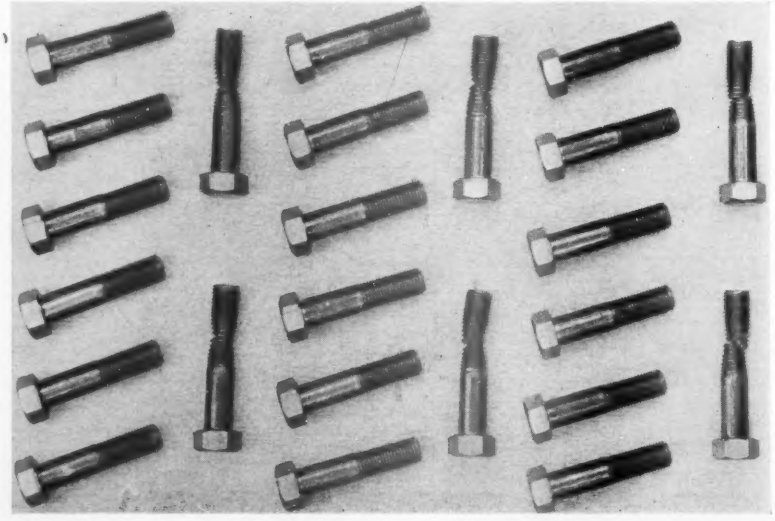
FOR most bolt and cap screw work, the diameter of commercial rod is usually specified in fractions of an inch with increments of 1/64 of an inch between sizes. While the allowable tolerance on the rod diameter is plus or minus 1/64" the actual diameter for the most part falls within the middle range and is much closer to size than the tolerance would indicate.



Cap Screws made from Hogue drawn wire showing fracture on tensile tests.

✦ ✦

Results of Tensile Tests

IN the first group of cap screws fabricated, the nominal diameter of the rod used was 25/64" and the actual average diameter .388". A test piece taken from this rod showed a tensile strength of 76,000 pounds per square inch.

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WHEN this rod was drawn to .364" in diameter with a draft of .024", it was reduced 12% in area and a test piece with this reduction showed the tensile strength to have increased from 76,000 to 91,500 pounds per square inch. After heading, these blanks were extruded, trimmed and roll threaded. The finished cap screws, without any heat treating, gave a tensile strength of 107,900 pounds per square inch, twenty-four hours after fabricating, which meets the most exacting commercial requirements on many classes of service.

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IN the second trial, a large diameter rod of the same S A E specifications as the first was used to determine the effect of an increased draft on the tensile properties of the finished screws. The rod of 13/32" nominal diameter, or .409" actual average diameter, was drawn to .364" as in the first test, but producing a heavier draft of .045". With this reduction in area of 20.9%, the tensile strength of the wire increased from 73,900 to 98,000 pounds per square inch. After the same finishing operations as before, the finished screws had a tensile strength of 111,400 pounds per square inch, twenty-four hours after fabricating, or an increase over the rod of 37,500 pounds due to the cold working of the metal.

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WHEN a still larger rod of 7/16" nominal diameter, or

.435″ actual average diameter, of the same S A E specifications was used, an even greater increase was obtained. This size rod, testing 76,600 pounds per square inch was drawn to .364″ in diameter in the Wire Drawer as before with a reduction in diameter of .071″. This 30% reduction in area increased the tensile strength of the wire to 107,800 pounds per square inch.

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AFTER heading, extruding, trimming and threading, the tensile strength of the finished screws was 117,900 pounds per square inch, twenty-four hours after fabricating, or a gain over the original rod of 41,300 pounds.

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THE results of these tests on the three different sizes of rod can best be summarized in table A.

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IN all of the determinations of tensile strength in these tests, the minor diameter, maximum was used. The above tests were made at periods of twenty-four, forty-eight and two hundred and forty hours after drawing or threading, and the fractures in every case occurred in the threaded portion of the screws.

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FROM the above data it may be readily seen that the bolt or cap screw manufacturer can, within certain limits, control the tensile strength of un-heat treated bolts and cap screws right at the header, when equipped with a wire drawing attachment. As the draft is increased, through the use of a larger diameter rod, the tensile strength of the finished product is also increased and provides an easy method of tensile control.

TABLE A

Tensile Tests on ⅜″—24 x 1⅝″ SAE Cap Screws
Material—SAE 1420 Hot Rolled, Unnormalized, Pickled and Limed Rod
Average Analysis—Carbon .21, Manganese .90

Rod diameter in inches			
Nominal	25/64	13/32	7/16
Actual	.388	.409	.435
Size drawn to inches	.364	.364	.364
Draft in inches	.024	.045	.071
Percent reduction in area	12%	20.9%	30%
Tensile of Rod—lbs. per sq. inch	76,000	73,900	76,600
24 hours after working			
Tensile of drawn wire p. s. l.	91,500	98,000	107,800
Tensile of finished screws p. s. l.	107,900	111,400	117,900
48 hours after working			
Tensile of drawn wire p. s. l.	92,000	98,700	109,300
Tensile of finished screws p. s. l.	109,500	112,500	120,300
240 hours after working			
Tensile of drawn wire p. s. l.	97,900	104,600	111,500
Tensile of finished screws p. s. l.	116,100	118,400	125,100

All physical and chemical determinations performed by The Frank Crobaugh Co. Laboratories, Cleveland, Ohio.

✦ ✦ ✦

Age Hardening

THE effect of age hardening is also shown in the table. Ten days after being threaded the first group of cap screws increased in tensile strength from 107,900 pounds per square inch twenty-four hours after threading to 116,100 pounds per square inch, or an increase of 8,200 pounds per square inch. In the same period, the second group increased from 111,400 to 118,400 pounds per square inch, or an increase of 7,000 pounds per square inch. The last group tested 125,100 pounds per square inch ten days after threading, showing a gain of 7,200 pounds over the tensile strength of 117,900 pounds per square inch twenty-four hours after threading.

THE Brinell hardness measured on the head of the screws twenty-four hours after threading was 202 in the first test, 207 in the second and 223 in the last, which conforms to the accepted standards on this class of work.

✦ ✦ ✦

Single and Double Draft

THE use of a single and double draft was also experimented with in this test to determine whether or not the tensile strength could be increased the same amount by drawing the wire in two lighter drafts totaling a reduction equal to that of a heavy single draft. While the number of pieces tested in this manner was not sufficient for a thorough investigation, it can be generally stated that the double draft does not increase the tensile strength of the finished product as much as a single draft of the same total reduction.

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NATIONAL METAL CONGRESS
At ATLANTIC CITY, N. J. OCTOBER 18th to 22nd, 1937

Measuring The Plating of Screw Threads

By E. C. Erickson

Telephone Apparatus—Electromechanical
Bell Telephone Laboratories, Inc., New York, N. Y.

In the absence of any standard gauging apparatus which could be used to make the determinations accurately for ascertaining the thickness coatings on finished screw threads, an optical contour projector was devised to determine such measurements. This article is a description of the apparatus and methods used. ✦ ✦

IN spite of the ever-growing number of substitute fastening devices, the common screw remains a very vital factor in mechanical construction. No better illustration of this fact can be given than that found in the telephone industry, which uses millions of screws and threaded parts. The ever-changing conditions under which the telephone must function and the continuous improvements in design call for a set-up of equipment, any single part or an entire unit of which may readily be removed for repair or replaced by some new or improved development. Thus many of the individual parts in telephone apparatus will be found held together by the common machine screw. These parts are attached to mounting plates which in turn are screwed to standard relay racks. The whole set-up from the individual piece of apparatus to the complete unit of assembly is held together by the machine screw. It is, therefore, not surprising that the Bell System gives much attention to the improvement in quality and the standardization of these threaded parts. National Standard screw thread sizes and fits have been adopted and much has been done in the methods of producing and gauging the various qualities of dimensional fit that are required in industry.

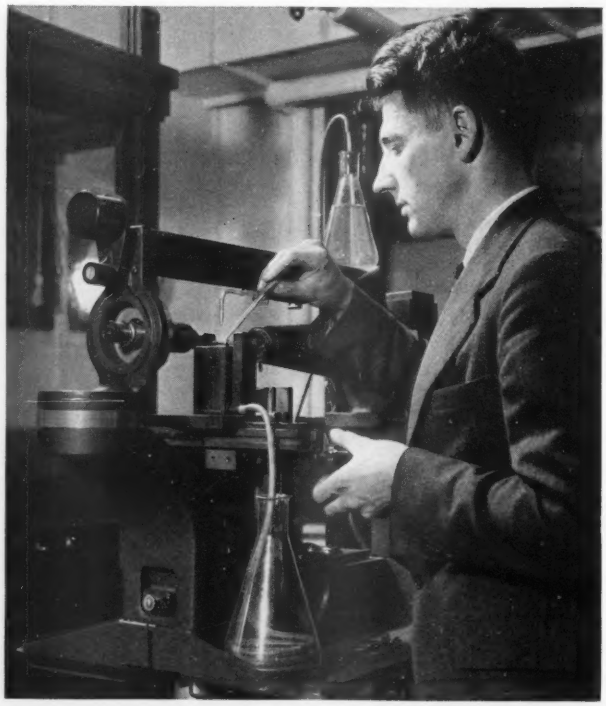
Printed by permission of Bell Telephone Laboratories Record.

Plated Screw Threads

THERE is one phase of the work, moreover, which has received little attention outside the telephone field. It involves plated or finished screw threads. Since telephone apparatus is subjected to all possible climatic conditions, it must withstand, among other things, any probable change in temperature and humidity. Thus iron screws which represent the bulk of the threaded product used in telephone apparatus must not only be free enough from a dimensional fit standpoint to be engaged or removed readily from their mating members and yet close enough to resist loosening under vibration but they must also be protected against rust or corrosion by a suitable coating or plate.

✦ ✦ ✦

THE corrosion protecting plate best suited to a screw thread from a dimensional fit standpoint is one which gives the maximum protection per milligram per square inch and is capable of the closest control of distribution and thickness over the uneven threaded area. The protective qualities of the various plates available have been determined previously in connection with other apparatus problems so that the work on plated threads is reduced to determining the thickness and uniformity of distribution of such finishes on threads.



✦ ✦ ✦

Optical Contour Projector For Gauging

IN the absence of any standard gauging apparatus which could be used to make such determinations accurately, a special method, which employs an optical contour projector, was devised. As illustrat-

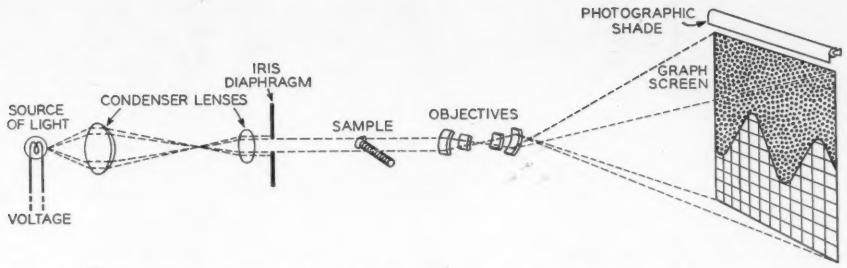


Fig. 1. Optical contour projector used to determine thickness of finish on screw threads.

ed in the diagram, this is essentially one in which the highly magnified contour of the screw without the finish or plate is superimposed on a record of the contour of the screw with the finish.

✦ ✦ ✦

Method of Testing

THE screw, after being carefully cleaned of any particles of dirt, is rigidly mounted in a jig at the object position of the projection system which is set at a definite magnification. The upper side of the screw is adjusted in the center of the field for the correct helix angle so as to insure a perfect outline of both sides of the thread as shown in Figure 1. A partial exposure of the image of the top of the thread with the plated finish is then made on photograph paper through a graph screen which provides graph lines along with the contour of the thread to aid in analyzing the results.* The finish is next removed from the threads by a stripping solution which is applied to the thread from a dropper after which it is carefully washed with distilled water and dried by a stream of heated air. This is all done without disturbing the relative position of the screw or the recording paper. A second exposure is then made, this time of the stripped screw, with the image superimposed on the image already made of the plated screw.

✦ ✦ ✦

BY observing the thickness and uniformity of distribution of the plate in this manner, it is possible to determine not only its suitability for screw thread use but also the adequacy of this process of applying it. This is shown in Figures 2 and 3 where two contourgraphs representing zinc plates of 50 milligrams per square inch are given. The finish can be seen as the partially exposed area surrounding the screw thread. In one case a sulfate solution was used and in the other a cyanide bath. The former deposits almost all of the zinc on the upper portion of the threads with almost no finish or protection against corrosion near the minor diameter. This uneven distribution also results in poor thread form and unsatisfactory engagement with the mating part. The cyanide bath gives a more uniform plate over the entire thread which not only offers good protection but simplifies the undercutting of the thread before plating.

* Record, March, 1932, p. 255.

✦ ✦ ✦

Records

ACCURATE records can be made by this method of samples of various finishes and it is possible to select by the uniformity of distribution and thickness, finishes or plates suitable for threaded work. This method also provides a means of determining the variation of the plate thickness.

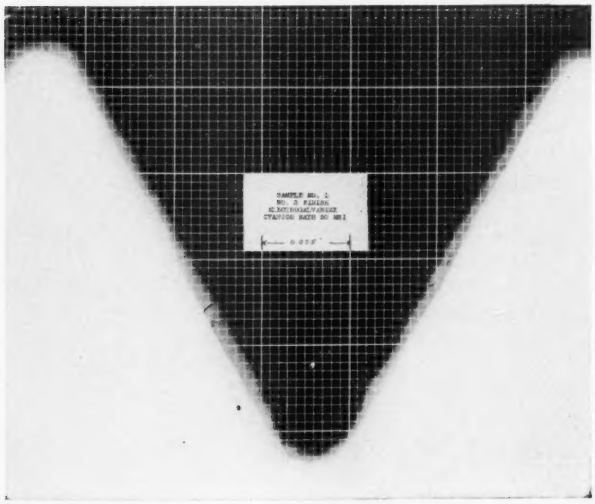


Fig. 2. Shadowgraph of a satisfactorily plated screw. ✦ ✦

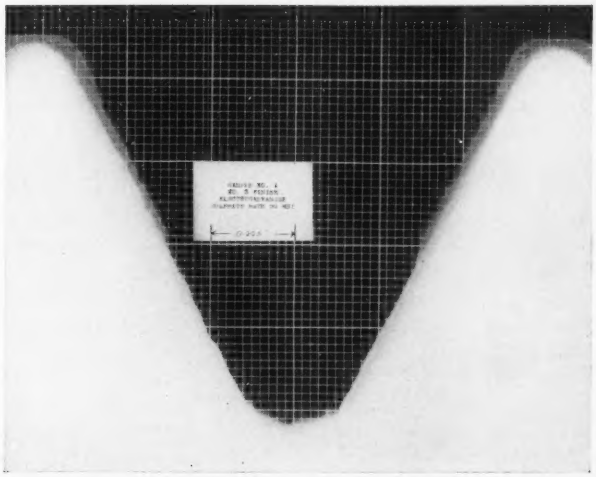


Fig. 3. This shadowgraph shows an unsatisfactory plate, since the deposit is almost entirely on the outside of the thread. ✦ ✦ ✦

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in Dec. 1936 and Dec. 1935
(In Gross Tons)

	Dec. 1936	Nov. 1936	Dec. 1935
Wire rods	1,467	3,493	2,943
Hoops, bands and strip steel	5,220	5,902	3,401
Plain, black or galvanized iron or steel wire	5,389	3,635	3,177
Barbed wire and woven wire fencing	5,145	2,484	3,411
Woven wire screen cloth	119	104	103
Wire rope	292	246	259
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	832	363	1,117
Wire nails	890	337	1,055
Tacks	31	17	16
Other nails, including staples	266	138	183
Bolts, machine screws, nuts, rivets and washers	734	598	481
Total, these 11 classifications	20,385	17,317	16,146

Imports of Iron and Steel Wire Into the United States
(In Gross Tons)

Concrete reinforcement bars	254	101	362
Hollow bars and drill steel	125	38	83
Wire rods	1,386	1,222	1,287
Barbed wire	1,529	480	2,192
Round iron and steel wire	417	437	337
Telephone and telegraph wire	.....	1	.....
Flat wire and strip steel	289	214	192
Wire rope and strand	180	171	278
Other wire	259	49	145
Hoops and bands	1,670	2,365	2,140
Nails, tacks and staples	704	531	2,114
Bolts, nuts and rivets	23	68	22
Total, these 12 classifications	6,836	5,677	9,152

Exports of Insulated Wire and Cable, December 1936

	Foreign		To U. S. Possessions	
	Pounds	Dollars	Pounds	Dollars
Insulated iron or steel wire and cable	28,533	$ 3,463	311	$ 226
Rubber-covered wire	497,223	102,217	127,715	25,164
Copper weatherproof wire	284,887	40,295	53,078	9,141
Copper telephone cable	77,085	9,557	53,392	4,437
Other insulated copper wire	289,413	60,496	167,956	27,923
Nickel-chrome electric resistance wire	29,212	33,055	.....	.....
Total, these 6 classifications	1,206,353	$249,083	402,452	$66,891

Exports and Imports of Wire

EXPORTS (excluding scrap) during December reached 135,147 tons valued at $9,998,926 in reaching the second highest monthly volume since August 1930—exceeded only by the trade in October 1936—and compared with 127,255 tons and $8,648,974 in the previous month, and with 90,889 tons and $6,402,022 in the equivalent one of 1935. Reviewing individual classifications—December against November—higher shipments prevailed in 45 items, against lower ones in only 16. By far the outstanding gain (11,073 tons) was that registered in 'other' plate export, followed by those in tin plate (3,800 tons), barbed wire (2,532 tons), pig iron (2,802 tons), plain shapes (2,307 tons), and 'other' steel bars (1,525 tons). A lower trade resulted chiefly in skelp which declined 12,181 tons, followed by the ones recorded in black steel sheets (6,858 tons), heavy rails (2,795 tons), and wire rods (2,026 tons).

✦ ✦ ✦

Tin Plate Shipments Continue Upward

AGAIN tin plate led in the export trade, a total of 24,377 tons going to a wide range of markets, the chief ones being Soviet Russia (3,229), Mexico (1,720), Brazil (1,617), the Union of South Africa (1,562), Japan (1,420), and Cuba (1,249). Next was 'other' plate (21,967 tons) with Sweden (14,616) by far the leading purchaser, others of importance being Mozambique (2,476), and China (1,013). Then came black steel sheets (10,489 tons) which found numerous markets, chief among which being Canada (3,693), the United Kingdom (2,057), Soviet Russia (1,135), and Mexico (1,132). Plain structural shapes (7,275 tons) ranked next and went chiefly to Canada (2,757), Sweden (2,165), the Philippine Islands (478), Brazil (444), Japan (421), and Cuba (417). Following were galvanized steel sheets (6,250 tons) in a widespread trade taking in chiefly the Philippine Islands (2,462), Colombia (907), Cuba (593), and Brazil (417). The outstanding markets for 'other' steel bars shipped to a total of 5,778 tons were Canada (2,683), the Philippine Islands (941), and Cuba (394).

✦ ✦ ✦

Leading Export Areas

IN December, North and Central America and the West Indies continued to be the leading area of purchase for American iron and steel products, taking 41,268 tons in accounting for 30.0 percent (42 percent in November) of all shipments made. Next came Europe which stepped its purchases up to 31,906 tons, or 24.0 percent (14.0 percent), followed by the Far East whose share was 26,930 tons, or 20.0 percent (20.0 percent). Next was South America (26,173 tons), or 19.5 percent (22 percent), followed by Africa — 8,870 tons — whose trade represented 6.5 percent (2 percent) of the total.

✦ ✦ ✦

Canadian Purchases Continue High

CANADA remained in its role as the leading market for iron and steel products (excluding scrap) shipped from the United States, during December taking 22,020 tons in a widely varied trade in which skelp (4,368), black steel sheets (3,693), 'other' steel bars (2,683), hot-rolled strip steel (2,533), and plain shapes (2,165 tons) predominated. Next came Sweden, surprisingly purchasing 17,776 tons—almost one-half its 1936 import aggregate from the United States—made up largely of 'other' plate (14,616), and plain shapes (2,165). Then came Mexico's varied total of 8,154 tons consisting largely of tin plate

(1,720), black steel sheets (1,132), cast-iron pressure pipe (358), car wheels, and axles (324), and barbed wire (321). Brazil ranked fourth accounting for 7,967 tons in which the most prominent products were heavy rails (2,407), tin plate (1,617), barbed wire (954), black steel sheets (608), plain shapes (444), and galvanized steel sheets (417). Next came the Philippine Islands (8,352 tons) whose trade included mostly galvanized steel sheets (2,462), tin plate (1,039), 'other' steel bars (941), cast-iron pressure pipe (633), and plain shapes (478). Japan's takings of 6,012 tons ranked next and in this trade the outstanding items were tin plate (1,420), wire rods (844), 'other' plate (536), and plain shapes (421). Next was the Union of South Africa (5,443 tons) in a trade made up largely of barbed wire (1,694), tin plate (1,562), galvanized wire (697), and 'other' plate (274).

✦ ✦ ✦

Lower Import Trade in December —Spiegeleisen Off Sharply

IMPORTS of iron and steel products (excepting scrap) amounted to 38,514 tons valued at $1,706,333 during December, and compared with 49,466 tons valued at $2,015,847 in November, and with 42,708 tons valued at $1,783,155 in the equivalent month of 1935. Compared with the trade in the previous month, lower import quantities were received in 17 classifications, higher in 19, and in 2 others no trade occurred in either month. Spiegeleisen receipts recorded the sharpest decline (8,959 tons), followed by those in 'other' pipe (1,377 tons), ferro-manganese (1,009 tons), 'other' hoops (695 tons), and shapes (514 tons). Although the gains were more numerous than the losses, most of them were unimportant, those outstanding being registered in barbed wire (1,049 tons), welded pipe (399 tons), rails (259 tons), 'other' wire (210 tons), and nails, tacks, and staples (173 tons).

✦ ✦ ✦

Pig Iron Leading Import Item in December

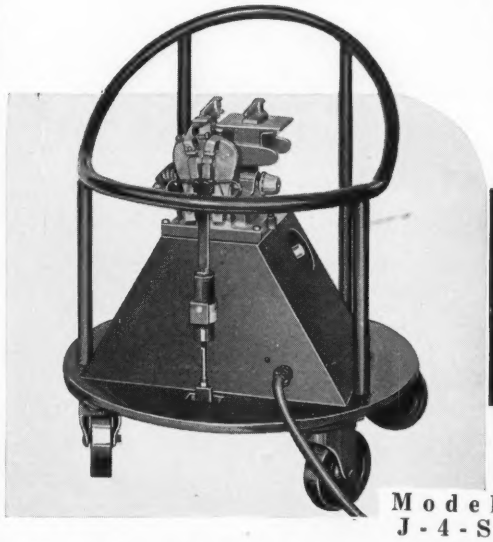
A TOTAL of 10,423 tons of pig iron was imported in December mostly from British India (4,750), Soviet Russia (3,108), and the Netherlands (1,898). Next in importance, structural shapes (all 'plain') were imported to the extent of 5,303 tons chiefly from Belgium (4,188), France (977), and Germany (123). Following was spiegeleisen (3,860 tons) all from Canada, with ferro-manganese (3,675 tons)—next in importance—coming principally from Norway (2,959), the Netherlands (279), and Poland (236). Solid and hollow bars (3,476 tons) were purchased chiefly from Belgium (2,551), France (471), and Sweden (326). The sixth product was 'other' hoops and bands (1,670 tons), with Belgium (1,146), and France (466) the outstanding suppliers.

✦ ✦ ✦

Belgium Leader in December Import Trade

IN December, Belgium ranked first as a supplier to iron and steel products (excepting scrap) to

(*Please turn to page 156*)



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General Office and Factory, Peoria, Illinois

A Review of Recent Wire Patents

No. 2,064,589, APPARATUS FOR HEATING WIRE, Patented December 15, 1936 by Wilber H. Convers, Poughkeepsie, N. Y.

Tension is exerted upon the wire, whereupon it is formed into U-shape and heated while in U-shape and while moving the wire longitudinally. This tension is transmitted from one part of the wire to another part by by-passing it around the portion being heated.

✦ ✦ ✦

No. 2,066,369. WOVEN WIRE BELT FOR PAPER MAKING MACHINES, Patented January 5, 1937 by Harry G. Specht, Montclair, N. J., assignor to Eastwood-Nealley Corporation, Belleville, N. J., a corporaton of New Jersey.

This invention incorporates in the warp wires of a Fourdriner paper making machine, reinforcing wires of greater tensile strength and hardness than the other wires making up the belt. It is claimed that, despite these wires, the belt will not crack, deform or wrinkle.

✦ ✦ ✦

No. 2,066,377, COIL HOLDER, Patented January 5, 1937 by Raymond J. Wean and Donald A. McArthur, Warren, Ohio, assignors to The Wean Engineering Company, Incorporated, Warren, Ohio, a corporation of Ohio.

The holder is particularly adapted for supporting coiled strip material while being unwound for subsequent processing.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

✦ ✦ ✦

No. 2,066,483, BICYCLE TIRE BEAD WIRES AND METHOD FOR THEIR MANUFACTURE, Patented January 5, 1937 by Charles Pearson, Ingersoll, Ontario, Canada, assignor to Morrow Screw and Nut Company Limited, Ingersoll, Ontario, Canada, a company of Ontario, Canada.

In bicycle tire bead wires, of the kind where the bead wire has its ends joined together to form closed loops embedded in the fabric of the tire bead, this inventor has provided a process whereby the formation of a joint is made without the application of heat.

✦ ✦ ✦

No. 2,066,484, SCREW, Patented January 5, 1937 by Henry F. Phillips, Portland, Oregon, assignor to Phillips Screw Company, Wilmington, Del.

A screw is provided having a tool receiving recess formed in the head, this recess comprising a bottom wall, convex side walls merging with concave and radially extending tool receiving grooves, being of equal width and tapering uniformly toward the bottom wall of the recess.

✦ ✦ ✦

No. 2,066,525, CONDUCTOR, Patented January 5, 1937 by John J. Gilbert, Douglaston, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

More particularly, this conductor is applicable to submarine cables and the inventor leaves off the insulation at intervals and conductively connects all of the strands together by means of a block of highly conductive material (such as solder or molten lead).

✦ ✦ ✦

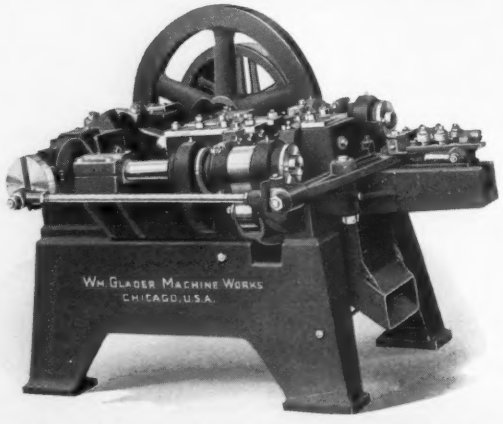
No. 2,066,861, UPHOLSTERY SPRING, Patented January 5, 1937 by Charles R. Simmons, Chicago, Ill., assignor to Nachman Spring-Filled Corporation, Chicago, Ill., a corporation of Illinois.

This spring comprises a single length of wire having annealed, bendable terminal end portions and a hardened body portion.

✦ ✦ ✦

Reissue No. 20,244, HIGH TENSION CABLE, Patented January 12, 1937 by Thomas F. Peterson, Worcester, Mass. Original No. 1,912,794, dated June 6, 1933.

HIGH SPEED WIRE NAIL MACHINE



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A Review of Recent Wire Patents

The construction includes a wire core and a covering about the wire but spaced therefrom, with a spacer element between the core and the covering having a surface sloping from the normal to the core. Thus, a space is provided for a fluid dielectric medium.

✦ ✦ ✦

No. 2,067,169, ELECTRIC CABLE, Patented January 12, 1937 by Charles James Beaver and Edward Leslie Davey, Cheshire, England, assignors to W. T. Glover and Company Limited, Manchester, England, a British Company.

A high voltage cable is provided, the inventors aiming to prevent the presence of remanent or occluded air or gas within the cable.

✦ ✦ ✦

No. 2,067,170, ELECTRIC CABLE, Patented January 12, 1937, by Charles James Beaver and Edward Leslie Davey, Cheshire, England, assignors to W. T. Glover and Company Limited, Manchester, England, a British Company.

The objects of this invention are substantially those as set out in patent 2,067,169.

✦ ✦ ✦

No. 2,067,214, METHOD OF COATING METAL, Patented January 12, 1937 by Robert R. Tanner, Highland Park, and John S. Thompson, Detroit, Mich., assignors, by mesne assignments, to The Patents Corporation, Detroit, Mich., a corporation of Michigan.

The method in this patent comprises producing on the metal a phosphate-containing coating by means of a solution containing the NO_3 radical, then rinsing the coated surface in a dilute water solution of chromic acid and covering the rinsed surface with a siccative coating, (such as of paint, varnish or enamel).

✦ ✦ ✦

No. 2,067,215, METHOD OF BONDING SICCATIVE COATS OF METAL, Patented January 12, 1937 by Robert R. Tanner, Highland Park, and John S. Thompson, Detroit, Mich., assignors, by mesne assignments, to The Patents Corporation, Detroit, Michigan, a corporation of Michigan.

In this patent the method is set out as forming on the metal a chemical coat of the group consisting of coatings on metal of oxide of the metal coated, on iron, steel, zinc and magnesium, of substantially insoluble phosphates, then treating as in patent 2,067,214.

✦ ✦ ✦

No. 2,067,216, METHOD OF COATING METAL, Patented January 12, 1937 by John S. Thompson, Detroit, and Herman J. Lodeesen, Berkley, Mich., assibgnors to The Patents Corporation, Detroit, Michigan.

This method comprises a variation of that described in patent 2,067,214, and incorporating portions of the steps set out in patent 2,067,215.

✦ ✦ ✦

No. 2,067,333, MEANS FOR PRODUCING INSULATED CONDUCTORS, Patented January 12, 1937 by John W. Olson, Hastings-on-Hudson, N. Y., assignor to Anaconda Wire & Cable Company, New York, N. Y., a corporation of Delaware.

A wire covering apparatus is provided including a device for advancing a conductor to be covered with supporting means rotatable about the axis of the advancing wire and a supply means for carrying a supply of strip material which is bent transversely about the advancing wire conductor.

✦ ✦ ✦

No. 2,067,359, STAPLE, Patented January 12, 1937 by Robert C. Tumminello, Colfax, La.

Biting means is provided at the extreme inner end of the staple in order to grip wire when the staple is in position.

The 1937
Wire Association Meeting
Will be Held at
Atlantic City, N. J.
October 18th to 22nd, 1937

OVERHEAD MATERIALS HANDLING EQUIPMENT

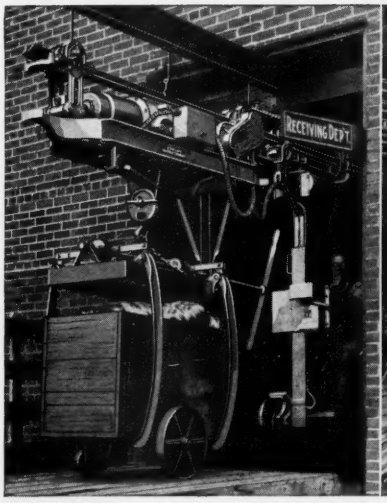

Photo T-1464 Photo T-1172

Photo T-1464
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Photo T-1172
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ACTING Commercial Attache Jule B. Smith, Prague, writes that the Technical University in Prague and the machinery concern Skoda Works, Prague, *Czechoslovakia*, are reported to have made satisfactory tests with a new method of tempering steel which in the tempering process replaces oil by apple juice. The apple juice preparation is called "Kolodit" and it is stated that if the method proves of practical value it may be of importance for Czechoslovak iron and steel works, because oil for this purpose must be imported.

Discussions At The Wire Association Meetings

AT CLEVELAND — OCTOBER, 1936

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Committee to Supervise Chinese Iron and Steel Works

REGULATIONS governing the formation of a Special Committee to supervise *Chinese* iron and steel works have been approved by the Executive Yuan, according to a radiogram from the office of the Commercial Attache, Shanghai. The Committee will consist of 5 members (appointed by the Yuan) who will examine production plans of each unit, and set up price standards for domestic iron and steel products. In addition, the Committee is to be charged with formulating China's trading policy in iron and steel products.

✦ ✦ ✦

Extension of International Drawn-Wire Cartel

DECISION has been reached by the Directors' Committee of the *International* Drawn-Wire Cartel (IWECO) to extend the cartel agreement without change until December 31, 1941, according to information from Acting Commercial Attache Jule B. Smith, Prague. The original agreement was reached on November 30, 1931 by Belgian, Czechoslovak, Danish, German, Hungarian and Dutch producers of drawn-wire and wire nails, and is in charge of export sales of those items which are affected by the Compagnie Internationale pour l'Exportation de Produits Trefile, Brussels. French cooperation has also been secured and, during 1936, agreements were made with the United Kingdom regarding the cartel's share of business on the British market, and with Austria, Norway and Sweden. The importance of the cartel rests in the fact that by allocating export quotas to the national industries of the member countries, it enables them to export their products under identical terms and conditions.

German Notes

Production and Export of Wire

THE IWECO closed its order books at Christmas and did not reopen them until the end of the second week in January. The present amount of unfilled orders in the hands of the IWECO is about 200% greater than the same time last year. Prices are now regarded unanimously as "Remunerative", because further advances took place, although not uniform, but for certain markets up to 10 shillings per ton and besides this high premiums were offered to exporters for prompt delivery. As "prompt", six to eight weeks have been regarded as satisfactory, whereas 10 to 12 weeks is a favorable shipment time, and 14 to 18 weeks the usual quotation. When the order books were reopened in January, business was "stormy" and the demand now exceeds by far the capacity of the industry. Of course, a very large proportion of the demand is speculation, as customers are buying in the expectation of a further upward movement of prices, but the real demand of the consumers is also regarded as rather satisfactory and the outlook for 1937 as a consequence appears very promising. The premiums offered by the buyers wishing to get wire are high. In one case up to $5 per ton has been offered. Orders from the United States, South Africa and all Latin American markets have been particularly large. Barbed wire, wire nails, and galvanized wire are chiefly in demand. The demand for wire ropes and all high quality steels is also very large. The prices are also up.

✦ ✦ ✦

The Price Situation

DOMESTIC prices for wire products will be left unaltered for the whole year of 1937, as is the case with iron and steel prices. In spite of the circumstance that the iron, steel and allied industries are now nearing the 100% of productive capacity, the Government is very anxious to maintain a "quantity boom" instead of a price boom. The supply of raw

(*Please turn to page 152*)

LAVITE

THE IDEAL HEATING MEDIUM

for

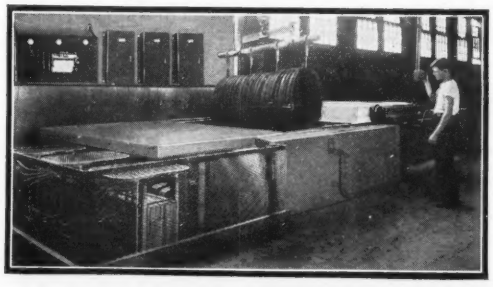
UNIFORMITY
PRESERVED SURFACE
CONTROLLED HEATING
EXACT TEMPERATURES

WIRE ANNEALING

LAVITE is a bath for controlled heating that does not deteriorate. Its unique characteristics produce uniform and more economical results, cleanly and rapidly.

LAVITE FURNACES

Built to meet your requirements for annealing.



Annealing Furnace

WRITE FOR COMPLETE LAVITE HEAT TREATING METHODS

THE BELLIS HEAT TREATING COMPANY
BRANFORD, CONNECTICUT

'Round the World With the Wire Industry

(*Continued from page 151*)

raw material to the industry is regarded at present as satisfactory.

✦ ✦ ✦

Aluminum Wire Mesh

THE substitution of aluminum metallic wire mesh for other metals has made further progress. At present this aluminum wire mesh is produced up to the thinnest diameters, and this circumstance, combined with the fact that the price for aluminum in Germany has been further reduced, whereas copper and other metals are much dearer, has accentuated this movement. The total quantity of copper, brass and bronze wire mesh produced for German domestic purposes in 1936 has been only approximately 180 tons; the export quantity was approximately 410 tons, and on this export market the demand for aluminum mesh shows also a rising tendency. Monel metal, greatly in favor on many markets up to 1935, appears to find less customers at present.

Speaking of large stocks:

We do not know whether our stocks of dies are "the largest in the U. S." because we never had the opportunity to check them against the stocks of our competitors. We do know, however, that besides the quantities that our main factories hold ready for immediate shipment to us on cabled notice, we carry at all times in America a stock averaging about 8,000 diamond dies.

This ought to satisfy the trade that we are in a position to give prompt deliveries.

Balloffet Dies and Nozzle Co., Inc.

Quality Diamond Dies since 1870

45-47 Adams Street

GUTTENBERG, N. J.

✦ ✦ ✦

Insulated Wire Cartel

IT is probable that the continental makers of cables and insulated wires will establish a cartel for export purposes, in which the principal cable products, particularly steel armoured cables and all sorts of lead cables would be included. Negotiations between the German, Czechoslovakian and Belgian industry have come already to a preliminary agreement.

✦ ✦ ✦

H. A. M. Van Hoffen, Manager, Wire Works, Union Steel Corp. Ltd., Transvaal, So. Africa

IT is interesting to note the world-wide influence of the Wire Association. Among the newer members, we have Mr. H. A. M. Van Hoffen of Vereeniging, Transvaal, South Africa. Mr. Van Hoffen is consulting engineer to the wire works section of the Union Steel Corporation, Ltd., of Vereeniging, Transvaal, South Africa, and has recently been appointed manager of their wire works.

✦ ✦ ✦

THE Salem Engineering Company announces removal of their offices in Salem, Ohio, to larger and more commodious quarters, the address being 521 East State Street.

✦ ✦ ✦

SALEM Engineering Company maintain offices at Salem, Ohio; Welland, Ontario; and London, England, and report from all offices a trend toward greater business.

Theodore B. Bechtel

THEODORE B. Bechtel, Sales Engineer of the Electric Furnace Company passed away at his home at Salem, Ohio, Sunday evening, February 7th. Funeral services were conducted on February 10th at The Stark Memorial, Salem, Ohio, and also on February 12th at the McClurg Funeral Home, Frankford, Philadelphia, Pa.

✦ ✦ ✦

MR. BECHTEL was an active member of The Wire Association, contributing to many of its activities, and his passing will be profoundly regretted by his many friends.

✦ ✦ ✦

William Gould, M. E., Begins Practice as Consulting Engineer

WILLIAM GOULD, M. E. Stevens' Tech. 1922, has been recently retained to draw plans for and supervise installation of a Wire Drawing Mill to manufacture both high and low carbon wire.

✦ ✦ ✦

MR. Gould first entered the wire industry in 1925 as foreman of a spring coiling department. Following his success here, he was given charge of the wire drawing mill connected with the plant of a large manufacturer of coil springs and allied products for furniture and bed spring use. He modernized the mill in every respect and also developed a simple mechanical means for controlling the **cast** of high carbon spring wire. Excellent results in the wire drawing department lead to successive assignments to other manufacturing departments. These included the manufacture of Coils and Constructions for Furniture and Auto Seats, Inner Spring Mattress Units, Studio Couches, Bed Springs, etc., etc.

✦ ✦ ✦

HE was thereafter put in charge of the Cost Work for the plant. When expansion of the business necessitated moving to larger quarters, he drew up plans, specifications and contracts and supervised all work in connection with moving and installation.

✦ ✦ ✦

COMPETENT authorities in the Wire and Spring Industry speak of Gould's unusual ability for critical study and analysis of industrial conditions and point out that he is "able, energetic, resourceful and . . . sound". He has also a background of Cost and Valuation experience with consulting engineers.

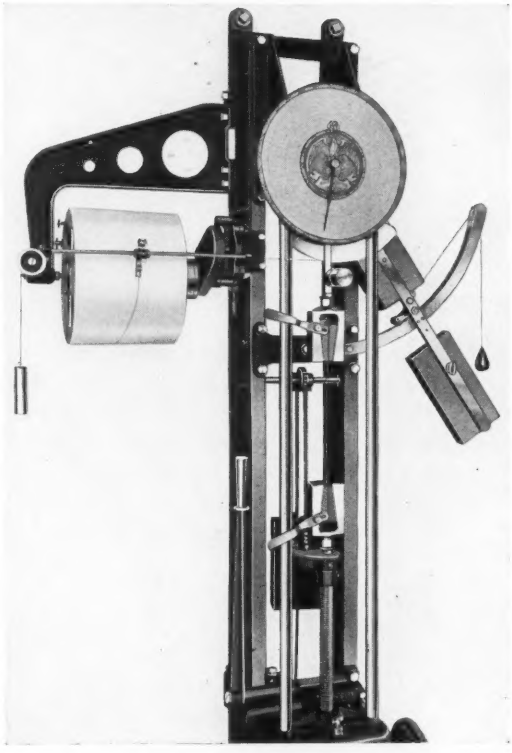
WE wish Mr. Gould every success in his new venture.

✦ ✦ ✦

Johnson Wire & Steel Co. to Build New Plant on Coast

JOHNSON Wire & Steel Company of Worcester, Mass., will build a new factory at Alameda Boulevard and Imperial Highway, at a cost of $100,000. The new plant will be used for the manufacture of high-carbon steel wire for beads on automobile tires. C. D. Johnson is president.

SCOTT WIRE TESTERS



Operate on the dead weight principle and are:

1. **Simple in design**
2. **Heavily constructed**
3. **Accurately made**

Our machines will give years of dependable, satisfactory, and inexpensive service.

The illustration shows our 500 and 1,000 pound capacity tensile machine with the famous autographic recorder which magnifies the test line to such proportions that yield, flow, and all other points of the test are clearly read from the graph.

No highly trained operator needed to obtain perfect work.

HENRY L. SCOTT CO.

101 Blackstone St. **Providence, R. I.**

Second Edition — NEW AND REVISED

WIRE DRAWING

AND THE

COLD WORKING OF STEEL

By

ALASTAIR T. ADAM, A.R.T.C.

PHOTOGRAPHS, DIAGRAMS & TABLES

THE publication of the first edition of "Wire Drawing and the Cold Working of Steel" occurred over ten years ago, but in this age of technical development the progress made is so rapid that such a period is sufficiently lengthy to make any text-book out of date, and in the preparation of the second edition of this valuable work the author has not been so much surprised that much has had to be revised, or rewritten, as that any of the text could be left without modification.

✦ ✦ ✦

THE main scheme of the original edition has been retained with its intention of so presenting the subject that it may be of interest to both the wire manufacturer and the wire user. Some matter has been eliminated, but much has been added, notably an entirely new chapter dealing with typical applications of wire; and although some of the old text remains unaltered, every chapter has been completely revised and several entirely rewritten. The volume has also been re-illustrated with a large number of photographs, diagrams and tables. Thus has been brought fully up to date the author's intention to explain the real nature of cold-worked products, and to show how the physical properties required for a particular process may be obtained.

✦ ✦ ✦

NEW — REVISED — UP TO DATE EDITION

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Book Department

WIRE & WIRE PRODUCTS

17 East 42nd Street New York, N. Y.

Bonderizing

(*Continued from page 138*)

ing process is designed to improve the surface of the metal treated to give a better base for applications of paint or lacquer, and to retard rust of the metal itself.

✦ ✦ ✦

THIS process is a method of chemically producing a phosphate coating on iron and steel, which coating is composed of millions of microscopic crystals, integral with the metal itself. Being insoluble in water, this coating effectively retards corrosion resulting from moisture that may penetrate the paint film and provide a foothold for the paint, which prevents flaking or peeling. The finishing material flows into the interstices between the fine crystals and, when dry, is securely anchored to the metal.

✦ ✦ ✦

THIS process essentially consists of a chemical bath suitable for the production to be processed. There are two different methods of Bonderizing in common use at this time—one an immersion and the other a spraying method. Processing by the immersion method is accomplished in from 2 to 5 minutes—by the spray method, in 60 seconds.

✦ ✦ ✦

THE quantity and character of work to be done determines which method should be used, and these factors, plus the type of installation decided upon, determine which one of the systems should be used. The Bonderizing Process is always preceded by a proper cleaning and rinsing system and is followed by rinsing and drying.

✦ ✦ ✦

Recent Literature on Springs

"**BETTER Springs for Electrical Products**" Anon., Electrical Manufacturing, Jan. 1937—Discusses factors influencing the selection of design and materials for springs, with several specific examples given as illustrations.

✦ ✦ ✦

"**BARRIERS to Hurdle in Successful Spring Buying**"—The Mainspring, February, 1937. Publication of the Wallace Barnes Co., Bristol, Conn. This article treats with the following factors from the

spring buyer's viewpoint: Design, Materials, Manufacturing Variations, Inspecting, Stock Storage.

✦ ✦ ✦

"CRANE Truck Stability Aided by Chromium Vanadium Springs"—Vanadium Facts, January, 1937. Describes the springing of industrial crane trucks manufactured by the Automatic Transportation Company at Chicago. Helical springs of chromium, vanadium steel, supporting the entire chassis, crane structure and load, form the basis of the rugged spring suspension now used on these industrial cranes.

✦ ✦ ✦

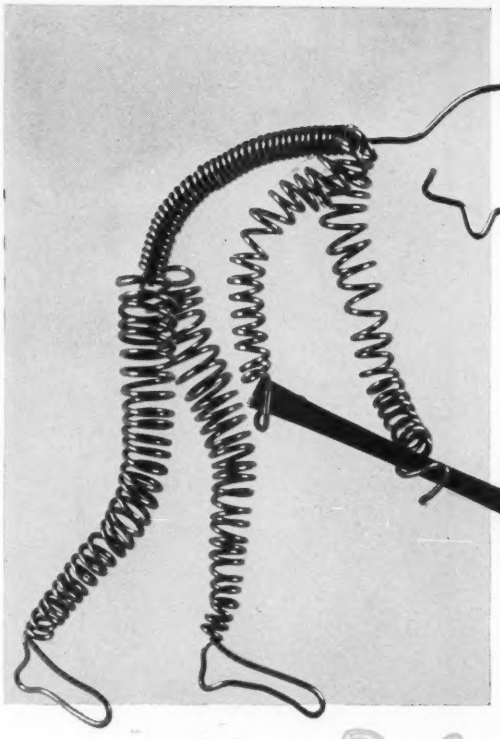
Westinghouse Office Moves

THE Westinghouse Electric and Manufacturing Company will move its Pittsburgh office and some of its general offices now located at East Pittsburgh to the Union National Bank Building in Pittsburgh. Occupying nine floors of the building, from the fifth to the thirteenth floors, the Pittsburgh district office, subsidiary district offices and headquarters offices including executive, legal, industrial relations, sales and accounting departments, will be centrally located in the Union Bank Building to facilitate their operations. Formerly the company's district office and subsidiary offices had been in this same building. The move will be made about May 1.

✦ ✦ ✦

NATIONAL-STANDARD CO., Niles, Mich., has purchased the physical assets of the Athenia Steel Co., Clifton, N. J., and will operate the plant as the Athenia Steel division. The personnel of this division will remain unchanged. The Athenia plant specializes in tempered and polished steel for clock, watch, motors, etc.

The 1937 Meeting of
the Wire Association
Will be Held at
Atlantic City, N. J.
October 18 to 22, 1937



Wire

. . . that WORKS for you

Digs right in and helps you turn out more volume, better products, with fewer delays and rejections. Keystone wire works perfectly in your plant because Keystone technical men do *their* work well: First, to develop the wire best adapted to your needs, and then to see that it is produced with exact uniformity . . . whether it's your second order or your hundredth.

Pass your wire problems on to Keystone. Prompt and careful attention is yours without obligation.

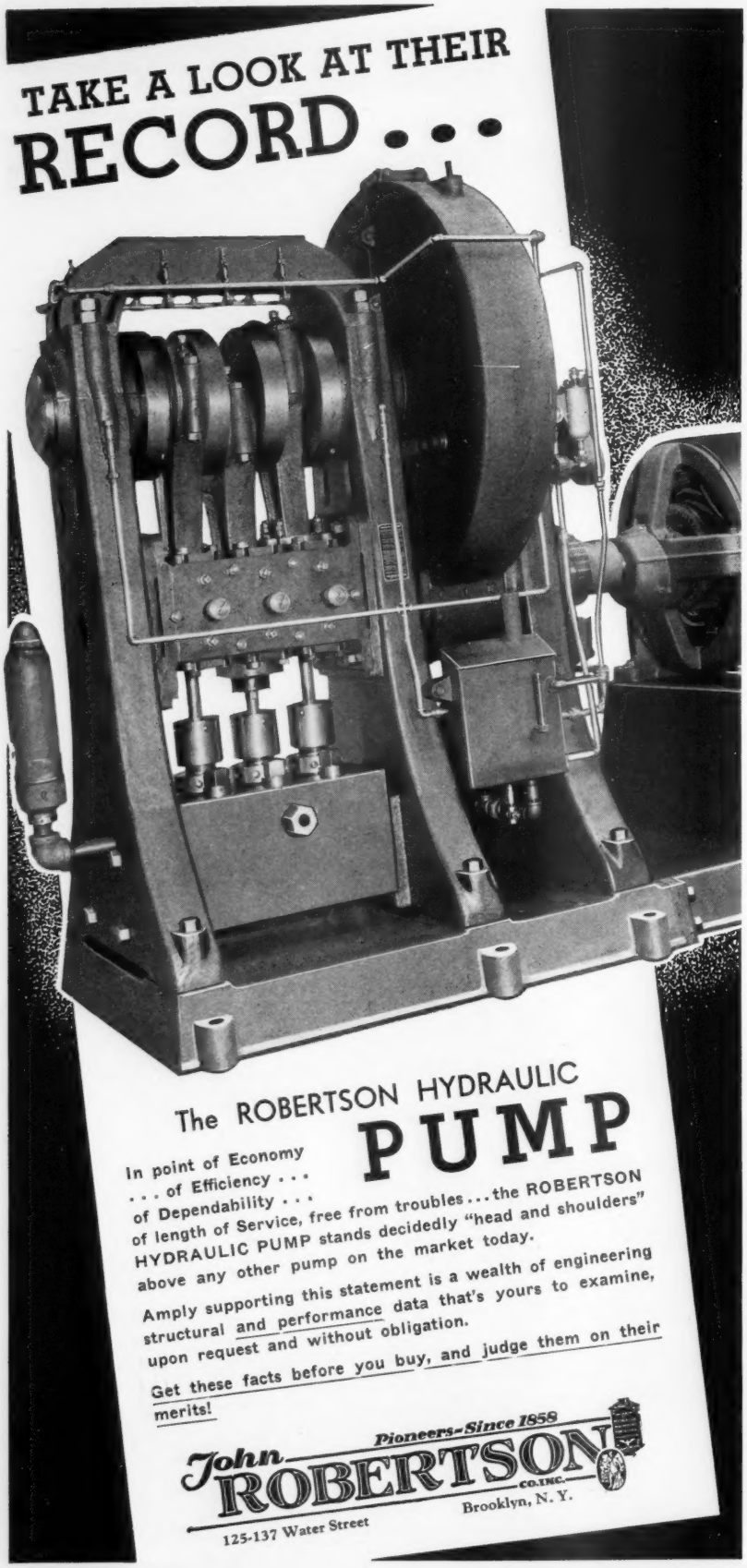
KEYSTONE

STEEL & WIRE CO. Dept. W., Peoria, Illinois

HIGH CARBON
or
LOW CARBON

SAMSON SPRING WIRE
KEYSTONE STEEL & WIRE CO. PEORIA, ILL.

Bright . . . Tinned
Coppered
Annealed
Galvanized


TAKE A LOOK AT THEIR
RECORD . . .
The ROBERTSON HYDRAULIC
PUMP
In point of Economy
. . . of Efficiency . . .
of Dependability . . .
of length of Service, free from troubles . . . the ROBERTSON
HYDRAULIC PUMP stands decidedly "head and shoulders"
above any other pump on the market today.
Amply supporting this statement is a wealth of engineering
structural and performance data that's yours to examine,
upon request and without obligation.
Get these facts before you buy, and judge them on their
merits!
Pioneers-Since 1858
John ROBERTSON CO. INC.
125-137 Water Street
Brooklyn, N. Y.

Exports and Imports of Wire

(*Continued from page 147*)

the United States, its total of 10,011 tons including chiefly shapes (4,188), solid and hollow bars (2,551), 'other' hoops (1,146), and sheets, skelp, and sawplate (861). Next was Germany (5,273 tons) sending in mostly barbed wire (1,361), 'other' pipe (1,259), sheets, skelp, and sawplate (600), and railway track material (472). British India—the next supplier of importance—confined its participation (4,750 tons) solely to pig iron. Canada's trade (4,537 tons) was mostly of spiegeleisen (3,860), and pig iron (367). Soviet Russia's participation (3,108 tons) was all of pig iron, while that of Norway (3,069 tons) was mostly of ferromanganese (2,959).

✦ ✦ ✦

DECEMBER receipts of CARD CLOTHING amounted to 38,493 square feet valued at $54,820 and came from the United Kingdom (29,707 square feet and $45,594), Belgium (7,340 square feet and $6,841), Germany (1,003 square feet and $1,463), Austria (378 square feet and $553), and Switzerland (65 square feet and $369). During 1936, an aggregate of 318,726 square feet valued at $431,306 was received, against 201,607 square feet valued at $254,463 in 1935, and 200,212 square feet valued at $246,187 in 1934.

✦ ✦ ✦

THE import total of WIRE CLOTH AND SCREENING for December was 89,774 square feet (127,935 square feet in November) and the chief suppliers were Germany (62,618), Canada (13,860), and the Netherlands (12,953). During the entire year, imports of this product totaled 1,006,726 square feet in comparison with 790,928 square feet and 649,467 square feet, respectively, in the two preceding years.

✦ ✦ ✦

WIRE HEDDLE imports during December at 803,000 pieces compared with 649,000 pieces in November and came from Germany

(*Please turn to page 158*)

Pickling of Metals and Alloys

"DECAPAGE des Metaux et Alliages" (Pickling of Metals and Alloys) is the title of a new book by G. de Lattre, with preface by G. Charpy, published by Dunod, 92 Rue Bonaparte, Paris, containing 189 pages, 41 charts and illustrations.

✦ ✦ ✦

THE author starts with a general review of the theory of solution of metals in acid, and the effect of various physical phenomena on the speed of the reactions.

✦ ✦ ✦

THE second section deals in a practical way with the pickling of ferrous alloys, solubility of oxides, influence of temperature, acidity, iron content, agitation, and various salts. Much attention is given to recovery of iron sulphate by various commercial processes. Materials and design of pickling and recovery equipment are reviewed, as well as testing and control of solutions, for muriatic as well as sulphuric acid practise.

✦ ✦ ✦

THE third section deals with the copper-base metals, the fourth with aluminum and its alloys, the fifth with operations preliminary and subsequent to actual pickling, and the sixth and last section deals with inhibition.

✦ ✦ ✦

THIS book is available only in the original French text.

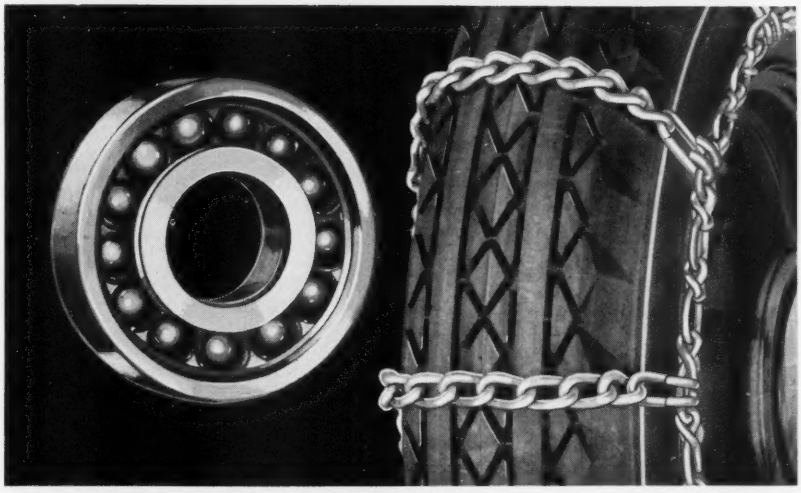
✦ ✦ ✦

Upson-Walton Co. Acquires Interest in Belleville Wire Rope Co.

UPSON-WALTON Co., 1310 West 11th St., manufacturer of wire rope, ship chandlery, etc., has acquired a controlling interest in Belleville Wire Rope Company, 691 Main Street, Belleville, N. J., and will consolidate. The Belleville plant will be expanded, including installation of additional equipment, and will be used for a new eastern branch.

FOR DETAILED PROCESS INFORMATION READ WIRE & WIRE PRODUCTS

FOR HIGH PRESSURES AND ABRASION



* KONIK

STEEL in Rods and Wire

In the ball bearing, where sheer strength and elasticity of the metal must transform theoretical point contact to an area and carry severe unit loads through innumerable cycles without fatigue, "Konik" shows its remarkable case-hardening, heat-treating, and physical properties. In tire chains "Konik's" high degree of workability, weldability, and ease of carburizing, speeds production and cuts costs. Its deep case resists abrasion, its tough core resists fracture, adding life and strength to tire chains. "Konik's" better chemical resistance cuts corrosion hazard in the bearing, reduces rust on tire chain.

Neither a high alloy steel nor a stainless steel, this patented steel, containing copper, nickel and chromium, is cutting costs and improving products for a number of manufacturers. Consult our metallurgists; find out what "Konik" will do for you.

CONTINENTAL STEEL CORPORATION
PLANTS AT CANTON, KOKOMO and INDIANAPOLIS

Manufacturers of

Billets and Wire Rods; Bright Basic, Annealed, Galvanized and "Konik" Wire; Nails, Staples, and Kindred Products.

Lawn, Chain-Link, Diamond Mesh, Farm and Poultry Fence; Barbed Wire and Bale Ties; Gates and Posts.

Black, Galvanized, Galvannealed, and Special Coated Sheets; Galvanized and "Seal of Quality" Roofing.

Tr. Mrk. Reg. U. S. Pat. Off. 10/11/35

"It ain't in there, Mister"

The Bearded Prophet, the Soothsayer, the Seventh Son of a Seventh Son, can't gaze into the crystal ball and find the answer to your corrosion problems.

Corrosion problems just aren't solved that way. Some are solved by the trial and error method; many of them are solved by the use of Duriron Company acid-resisting equipment.

Of course, we are much in favor of the latter method. But, after all, what difference does it make whether the equipment is called **Duriron, Durichlor, Durimet, Durco Alloy Steels,** or **Alcumite** —so long as it does the job satisfactorily?

You are interested in results . . . in lower costs of maintenance . . . in more trouble-free service from your equipment.

We've got something for you that will handle acids or acid solutions.

So, if you have a corrosion condition that is troublesome, find out if we can help you any. We shall be glad to work with you.

THE DURIRON COMPANY, Inc.

445 N. Findlay St. Dayton, Ohio

NORBIDE ABRASIVE . . .

The choice of users of carbide dies for economical shaping, ripping and finishing.

NORTON COMPANY, WORCESTER, MASS.

N-32

NORTON ABRASIVES

Exports and Imports of Wire

(*Continued from page 156*)

(753,000), and Switzerland (50,000).

✦ ✦ ✦

DECEMBER receipts of FOURDRINIER AND OTHER PAPER-MAKING WIRE reached 41,154 square feet against 27,515 square feet in November and came from Austria (15,523), France (13,276), Germany (6,470), Sweden (2,162), the Netherlands (2,038), and Czechoslovakia (1,675).

✦ ✦ ✦

NO trade whatever occurred in WIRE FENCING AND NETTING, galvanized before weaving, as compared with a total of 96,700 square feet received in November. During the entire year the total was 5,271,201 square feet against 7,199,597 square feet in 1935, and 9,589,775 square feet in 1934. Of the galvanized after weaving grade, December recepits stood at 40,000 square feet (371,000 square feet in November) and came entirely from Germany.

✦ ✦ ✦

EXPORTS of iron and steel wood screws during December, 1936 totaled 33,261 gross valued at $6,287. Of this total Cuba took 15,474 gross valued at $1,577; Uruguay 2,850 gross valued at $286; Mexico 2,360 gross valued at $641; Union of South Africa 1,920 gross valued at $239; Venezuela 1,875 gross valued at $195; Colombia 1,653 gross valued at $234; Argentina 1,080 gross valued at $1,935.

✦ ✦ ✦

EXPORTS of brass wood screws during the same month totaled 5,732 gross valued at $1,953. Of this total Cuba took 3,012 gross valued at $859; Panama 772 gross valued at $250; Canada 692 gross valued at $390; Venezuela 519 gross valued at $67; Bermuda 296 gross valued at $158.

✦ ✦ ✦

IMPORTS of wood screws during the same month totaled 45,581 gross valued at $2,314. Of this total Japan supplied 34,794 gross valued at $2,403; Belgium 9,762 gross valued at $743; United Kingdom 230 gross valued at $55; Germany 700 gross valued at $72; Canada 95 gross valued at $41.

Twisted Paper Cords For Insulating Wire

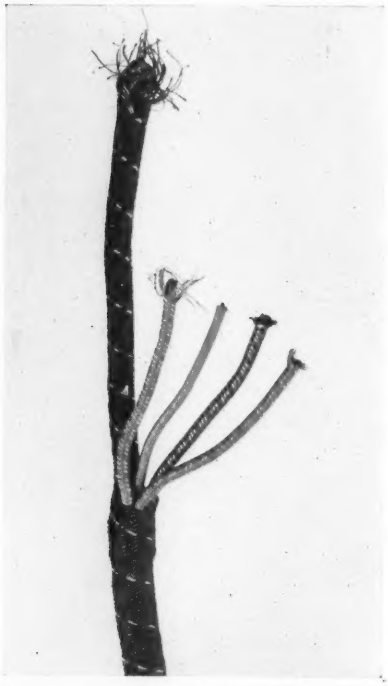
By E. R. Chatterton, Treas.

E. W. Twitchell, Inc., Philadelphia, Pa.

THE electrical wire trade, of course has long been familiar with various kinds of paper and their uses in the electrical field.

✦ ✦ ✦

THEY have as well a full knowledge of the uses of folded and twisted paper cords not only for house wiring but for automotive uses as well.



Photograph of cable or harness in which .032 black paper yarn is used. ✦ ✦ ✦

AUTOMOTIVE plants have, however, we believe gone a step beyond the regular electrical wire manufacturers in that they have used for some time small sizes of paper twine such as .028 and .032 as an absolute outside braid containing only a few cotton warp threads. This braid is used quite generally by manufacturers of motor cars as a means of holding all the ignition wires in one cable. After braiding it is of course, subjected to a waterproofing agent of a soluble shellac nature. By reason of its service for many years in varying temperatures it has proven its reliability. In winter alone, the temperature under the hood can at times quickly vary from freezing to almost 200°. It is now also being used quite extensively as an outside braided cover on battery cables. It has served satisfactorily in this capacity we understand for some time because of its abrasive resisting qualities.

✦ ✦ ✦

WE believe its use, as an outside braider replacing cotton or silk, could also be extended tremendously in general electrical wire work to advantage.

✦ ✦ ✦

PAPER twines are now available in sizes from .020 diameter and up. Shortly the paper twine industry promises paper yarns as fine as .010.

✦ ✦ ✦

Advantages of "Cellophane" For Insulating Wire

"CELLOPHANE" is also a product that is fast becoming popular in the wire trade. While it is well known, its many uses have never been thoroughly investigated by this trade.

✦ ✦ ✦

SOME of its desirable characteristics are as follows:

1. **Resistance to oil, grease and saturants.**
2. **Very high tensile strength for a given weight or thickness.**
3. **High resistance to heat.**
4. **When colored for identification purposes, it is not appreciably affected by saturants.**
5. **Good flexibility.**

✦ ✦ ✦

THERE is no doubt that these properties in strip, twisted, folded or crushed form will find many unusual uses in the electrical field.

✦ ✦ ✦

AMONG these may be visualized a tubular loom or covering, very resistant to oils and greases and possibly also to abrasion based on the toughness and flexibility of "Cellophane" cellulose film—as a colored filler with permanent color for marking and identification or

(*Plase turn to page 160*)

AMALOY

Saves Your Dies (One Annealing)

With the continuous lead coating of AMALOY you can draw stainless steel rod from .28" to .020", with only ONE annealing. This means faster production, lower costs and greater earnings.

With less handling and the speeding up of drawing operations as a prime consideration, you can enjoy the added advantage of prolonging the life and usefulness of your dies.

A Tenacious Drawing Lubricant

The lead coating of AMALOY adheres tenaciously down to the finest strands, a marvelous lubricant; the coating bond with the underlying wire can be convincingly demonstrated as to tenacity by a continuous drawing and redrawing without breaking the continuity of the lead coating.

AMALOY is amazingly different —easily and quickly adapted, extremely flexible and will flow with the longation and reduction throughout the drawing operation. It retards work hardening and therefore increases work life of the material to be drawn.

A Protective Coating for Conductors

A steadily growing number of insulated wire manufacturers use AMALOY as a substitute for tin coating on rubber insulated copper conductors, at a fraction of the cost of tin coating and with much better results.

It has the full approval of the Underwriters Laboratories.

American Machine & Foundry Company

Sales Office:
511 Fifth Avenue, New York, N. Y.
Factory:
5502-5524 Second Ave., Brooklyn, N. Y.

WARNER COMPANY
Lime
Bell Mine
Products
BELLEFONTE DIVISION

Choose and Use

Bell-Mine Pulverized Lime

In Wire Drawing

It is uniformly burned, high in calcium oxide content, pure and free from grit.

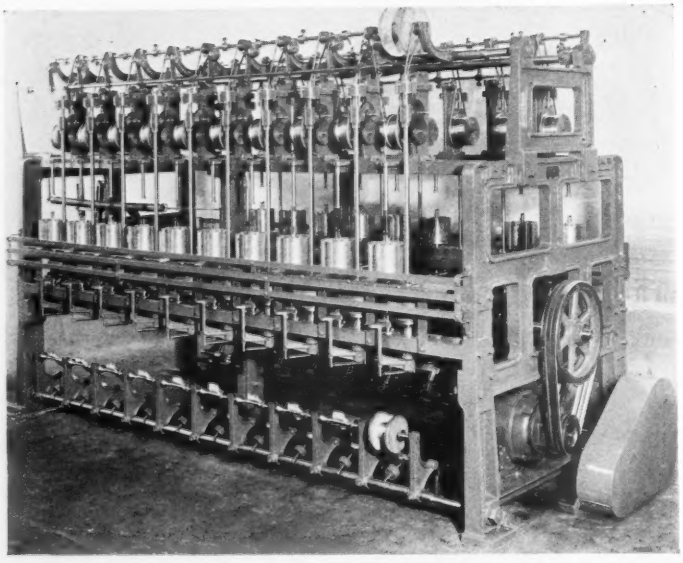
MANUFACTURED BY

American Lime & Stone Company

BELLEFONTE, PA.

Warner Company.

BELLEFONTE DIVISION



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"American"
INSULATING
MACHINERY
COMPANY
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Twisted Paper Cords for Insulating Wire

(*Continued from page 159*)

possibly to give a more flexible cable or wire due to the fact the cord will not saturate and stiffen when treated with solvent type of coating.

✦ ✦ ✦

AS a possible answer to the tree wire problem, hard twisted "Cellophane" cords are now being considered by some manufacturers for outside covering in spiral or braided forms.

✦ ✦ ✦

Recovery of Steel From Acid Brittleness

(*Continued from page 128*)

(11) High carbon steels cannot be efficiently baked at 100°C.

(12) The longer the time of pickling, the more the embrittlement induced, but the steel follows the same path of recovery, except that it begins to recover from a lower value of toughness.

✦ ✦ ✦

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The 1937
Wire Association Meeting
Will be Held at
Atlantic City, N. J.
October 18th to 22nd, 1937

Carboloy Issues Bulletin on Grade Selection

MUCH information of practical value to users or prospective users of cemented carbide tools is contained in Engineering Bulletin No. TA-371, just issued by Carboloy Company, Detroit, Michigan on the subject of proper carbide grade selection. This 12 page bulletin explains the necessity of considering (1) type of material being machined (2) name of part to be machined (3) machining specifications and (4) type of machine used, in the selection of cemented carbides. An extremely useful section of this bulletin is that devoted to an alphabetical listing of iron, steel, non-ferrous metals and non-metallic materials with the suggested grades of Carboloy for roughing and finishing operations on each material. Supplementing this is a list of Carboloy grades giving their physical characteristics and recommended applications.

✦ ✦ ✦

THE entire bulletin is designed so that it is relatively easy for one to choose the grade suitable for his particular job. In the selection of cemented carbides, the data contained in TA-371 should prove exceptionally helpful. Copies of this bulletin may be obtained upon request, from Carboloy Company, Inc., 2985 East Jefferson Avenue, Detroit, Michigan.

✦ ✦ ✦

THIS company also advises that their Pittsburgh office has supplemented its service to the southeast territory with an additional district representative, Mr. J. E. Weldy, 1107 South 30th Street, Birmingham, Alabama.

✦ ✦ ✦

MR. Weldy was formerly located in the Detroit district sales office and prior to that he was a special representative for the Carboloy Company in the State of Minnesota.

The 1937
Wire Association Meeting
Will be Held at
Atlantic City, N. J.
October 18th to 22nd, 1937

Carnegie-Illinois Joliet Plant to be Transferred to American Steel & Wire

TRANSFER of the Joliet, Ill., plant and property of the Carnegie-Illinois Steel Corporation to the American Steel & Wire Company became effective January 1st. Both organizations are United States Steel Corporation subsidiaries. Property transferred will include the splice bar mills, spike mill, merchantile mills and bolt and nut factory. The Carnegie-Illinois Steel Corporation will retain two blast furnaces and the coke plant.

✦ ✦ ✦

WITH the exception of the two blast furnaces and coke plant, operations formerly conducted in Joliet by Carnegie-Illinois will be continued under the management of the American Steel & Wire Company who now operate the Rockdale and Scott Street works. In addition the wire company will operate new rod mills now under construction on the property. The Carnegie-Illinois Steel Corporation will continue to market the track accessories manufactured at the Joliet works as it has done in the past. These products include angle bars, cut-thread bolts, heat-treated bolts, spikes and screw spikes.

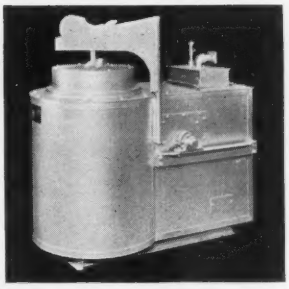
✦ ✦ ✦

American Steel & Wire Co. Changes in Personnel

CLIFFORD E. HOOD, vice president in charge of operations, American Steel & Wire Co., Cleveland, has been appointed to the newly-created position of executive vice president. M. W. Reed, assistant to vice president and chief engineer, succeeds Mr. Hood as vice president in charge of operations.

✦ ✦ ✦

H. B. JORDAN, heretofore manager of Cleveland district mills, has been named assistant to the vice president, and G. H. Rose, construction engineer, has been promoted to chief engineer. B. H. Gedge has been appointed manager of Cleveland district mills, succeeding Mr. Jordan, and W. F. Munford becomes superintendent of the Cuyahoga works.



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Welded Alloys Rolled to Infinitesimal Thickness

STRIPS of two alloys, Copnic and Chromel, were welded together and rolled to a thickness of six millionths of an inch recently in the laboratories of the General Electric Company. Even when magnified 250 times the weld in the ultra-thin bimetallic foil can be distinguished only by the difference in color between the two alloys.

✦ ✦ ✦

GOLD has been beaten to four millionths of an inch, and aluminum has been thinned by the same treatment to ten millionths of an inch; but this is the first time two alloys have been welded together and then reduced to such a thin section by rolling.

✦ ✦ ✦

THE six millionths of an inch thickness was achieved by placing the welded strips of the two alloys—the one of copper and nickel and the other of chromium and nickel—between pieces of steel and reducing the combination as a unit by passing it between rolls. The final product of the rolling process is as delicate as gold leaf and must be handled with equal care.

✦ ✦ ✦

THE two alloys might have been lap welded after being rolled, according to engineers in charge of the work, but such a procedure would not have given the same clean appearance and uniform characteristics. Rolling is the only method known by which such extreme and uniform thinness can be obtained in metals.

✦ ✦ ✦

LINDBERG Engineering Company announces that Mr. L. A. Shea, formerly Chicago District Manager for the Hevi Duty Electric Company, has joined their organization in the capacity of Assistant Sales Manager. Mr. Shea had been with the Hevi Duty Electric Company for eleven years, most of his time having been spent in the Engineering Department.

Industrial Safety Booklet

THE National Safety Council recently published an attractive booklet on industrial safety that is an excellent delineation of what intelligent accident prevention work can and should mean to industrialists and plant operation.

✦ ✦ ✦

BETWEEN its covers is the profound comment of more than a score of the leading "big names" in American industry. Each gives unstinting praise to the value of safety—most of them itemize and interpret what it has meant in their particular businesses in terms of reductions in accident frequency and severity. Most of them point out that improved safety in their plants has brought increased profits. And, most of them emphasize as most important that their plant organizations for safety have saved thousands of employees from accident-death and injury.

✦ ✦ ✦

AMONG the men who contributed voluntarily to the booklet were such outstanding figures as R. H. Cabell, President of Armour and Company; Lammot duPont, President of E. I. duPont de Nemours and Company; Alfred P. Sloan, President of General Motors; P. W. Litchfield, President of Goodyear Tire and Rubber Company; S. G. McAllister, President of International Harvester Company; S. A. Holman, Vice-President of Libby, McNeill & Libby; Paul Hoffman, President of The Studebaker Corporation; G. T. Swift, President of Swift & Company; F. B. Davis, Jr., President of United States Rubber Products, Inc.; Edgar S. Bloom, President of Western Electric Company.

✦ ✦ ✦

TO the fellow who has an accident problem in his plant and yet is not completely sold on the efficacy of a plant safety organization and doubts that formation of such an agency would be good business, this booklet would, indeed, be tonic to change his attitude. The National Safety Council distributes the booklet without charge.

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S. S. Marshall, Jr., Gen. Operating Manager of Jones & Laughlin Steel

S. S. MARSHALL, JR., has been appointed general manager of manufacturing operations of the Jones & Laughlin Steel Corporation.

✦ ✦ ✦

SINCE February 6, 1936, Mr. Marshall has been assistant general manager of manufacturing operations and before that he was general superintendent of the Pittsburgh works.

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Carboloy Adds to Engineering Staff

CARBOLOY Company, Inc., Detroit, Michigan, manufacturers of Carboloy cemented carbide tools, dies and wheel dressers announces the appointment of **Frederick W. Lucht** to its engineering staff at Detroit. Mr. Lucht was formerly with the McCrosky Tool Corporation of Meadville, Pennsylvania, and prior to that he was connected with Goddard & Goddard Tool Company, Detroit, Michigan.

FRED W. LUCHT

ANNOUNCEMENT is also made of the appointment of Mr. **Fred Schonberger** as an additional representative in the Philadelphia territory. Mr. Schonberger has been associated with the cemented carbide field for several years. He has been assigned to the area comprising eastern Pennsylvania, southern New Jersey, Delaware, Maryland, District of Columbia, and the eastern portion of Virginia.

Research on Tire Chains at Mellon Institute

AN Industrial Fellowship that is investigating broadly the durability of automotive tire chains has been founded at Mellon Institute of Industrial Research by The McKay Company of Pittsburgh, Pa., which manufactures commercial chains of all types. This Fellowship, which began operation on September 15, 1936, has for its objective the production of better chains, particularly for the motorist. A comprehensive program of basic research is being carried on, including studies of the design, materials, processes of manufacture, and testing of chains.

✦ ✦ ✦

THE McKay Fellowship is headed by **Dr. David F. Helm**, who received his professional education at Denison University (A. B., 1928), Michigan State College (M. S., 1930), and Ohio State University (Ph. D., 1934). Prior to joining the research staff of Mellon Institute, Dr. Helm was employed as research engineer on cast iron metallurgy in the Engineering Experiment Station of the Ohio State University; previously he was a chemist with the Midgley Foundation, Columbus, Ohio.

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New Mechanical Book Describes Solution of Metal Problems

A NEW booklet describing the solution to scores of actual metal problems as encountered by the engineer has just been issued by The International Nickel Company. Containing 48 pages, illustrated throughout, this booklet has been prepared primarily as a guide book to Monel and other non-ferrous nickel alloys in the fields of engineering applications. It also covers the corrosion resistance and other properties of these metals.

✦ ✦ ✦

THE booklet includes 20 subdivisions, each devoted to specific problems in fields from hydroelectric and steam power plants to highway maintenance, refrigeration and automobiles.

✦ ✦ ✦

BESIDES going into details of standard Monel the booklet describes some of the newer forms of this alloy, including "K" Monel, "S" Monel and the like. The nonmagnetic forms of the metal are also covered in a special section devoted to airplanes and the like. Inconel, the high nickel-chromium alloy, is another subject covered.

✦ ✦ ✦

SPECIAL items included are those dealing with meters and other regulating equipment, sewage disposal, pump maintenance and other items of general interest. The booklet is available without charge to members of all branches of the engineering profession.

✦ ✦ ✦

Micarta in Steel Mills

A NEW leaflet entitled, "Micarta in Steel Mills" has recently been issued by the Westinghouse Electric and Manufacturing Company. Illustrated are applications of Micarta bearings, rings and standard miscellaneous shapes. Also, a booklet entitled "Where Can You Use Micarta" includes a description of Micarta, its mechanical and electrical properties and the standard forms available. Copies are available from Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

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Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

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Rusch Wire Die Corp., New York, N. Y.

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Kelly Wire Die Corp., New York. N. Y.
Master Wire Die Corp., New York, N. Y.
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John Robertson Co., Brooklyn, N. Y.

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Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Union Wire Die Corp., Stamford, Conn.
Vianney Wire Die Works, New York, N. Y.

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Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Union Wire Die Corp., Stamford, Conn.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Vianney Wire Die Works, New York, N. Y.

DIES—Steel
Master Wire Die Corp., New York, N. Y.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.

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FURNACES—Automatic
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FURNACES—Electric
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Surface Combustion Co., Toledo, O.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.
Lindberg Engineering Co., Chicago, Ill.
Surface Combustion Co., Toledo, O.

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Electric Furnace Co., Salem, O.
Lindberg Engineering Co., Chicago, Ill.
Surface Combustion Co., Toledo, O.

GALVANIZING—Special Process
Meaker Company, The, Chicago, Ill.

GEARS—Wire Mill
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Farrel-Birmingham Co., Ansonia, Conn.
Norton Co., Worcester, Mass.

HANDLING EQUIPMENT—Material
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

HOISTS—Electric Traveling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

HOISTS—Monorail
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS
American Chemical Paint Co., Ambler, Pa.
Parkin Co., The Wm., Pittsburgh, Pa.

INSULATION—Cable or Cable Filler
E. W. Twitchell, Inc., Phila., Pa.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—Pulverized
Warner Company, Bellefonte, Pa.

LININGS—For Acid Tanks
American Hard Rubber Co., New York, N. Y.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Magnus Chemical Co., Garwood, N. J.

LUBRICANTS—Wire Drawing
Magnus Chemical Co., Garwood, N. J.
R. H. Miller Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.
New England Butt Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Coilers
Broden Const. Co., Cleveland, O.
Elevator Supplies Co., Inc., Hoboken, N. J.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Waterbury-Farrel Foundry & Machine Co. Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading
Ajax Manufacturing Co., Euclid, O.

MACHINERY—Copper Wire Drawing and Rolling
Elevator Supplies Co., Inc., Hoboken, N. J.
Farrel-Birmingham Co., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Covering Wire—
Syncro Machine Co., Newark, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Hallden Machine Co., Thomaston, Conn.
F. B. Shuster Co., New Haven, Conn.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Electro - Galvanizing Wire
Meaker Co., The, Chicago, Ill.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa
Elevator Supplies Co., Inc., Hoboken, N. J.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Meaker Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
Elevator Supplies Co., Inc., Hoboken, N. J.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis., and Providence, R. I.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works Co., Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Machinery Co., Phila.
Elevator Supplies Co., Inc., Hoboken, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Hoboken, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Hoboken, N. J.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila. Pa.
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Hoboken, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Special—Combination Machine for Drawing, Cutting-to-length, Straightening and Reeling Bars from Coil in One Operation (Shumag Type)—
W. A. Schuyler, New York, N. Y.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
Elevator Supplies Co., Inc., Hoboken, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

BUYERS' GUIDE, Continued

Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Swaging
Elevator Supplies Co., Inc., Hoboken, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Wire
Henry L. Scott Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
F. B. Shuster Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Euclid, O.
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Elevator Supplies Co., Inc., Hoboken, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Hoboken, N. J.

MACHINERY—Wrapping Wire
W. A. Schuyler, New York, N. Y.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MONORAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

OVENS—Annealing or Drying
Lindberg Engineering Co., Chicago, Ill.
Ross Engineering Corp., New York, N. Y.

PAPER—Insulating
E. W. Twitchell, Inc., Phila., Pa.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Co., The Wm., Pittsburgh, Pa.

PICKLING—Tank Linings
American Hard Rubber Co., New York, N. Y.

POTS—Annealing, Case Hardening and Tempering
Lindberg Engineering Co., Chicago, Ill.

POTS—Lead Melting
Farrel-Birmingham Co., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Farrel-Birmingham Co., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Sleeper & Hartley, Inc., Worcester, Mass.

REEL CRUTCHES
Watson Machine Co., Paterson, N. J.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Morrison Engineering Co., Cleveland, O.

RODS—Wire—Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., St. Louis, Mo.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLLS—
Farrel-Birmingham Co., Ansonia, Conn.

RUST PROOF COMPOUND
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.
R. H. Miller Co., Homer, N. Y.

SKIN PROTECTOR—
Magnus Chemical Co., Garwood, N. J.

SOAPS—Industrial and Wire Drawing
Magnus Chemical Co., Garwood, N. J.

STRIP—Brass, Zinc and Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS—Wire
Henry L. Scott Co., Providence, R. I.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Proof
Duriron Co., The, Dayton, O.

VULCANIZERS
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., St. Louis, Mo.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Co., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., St. Louis, Mo.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Company, Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification For Special Purposes
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel and Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Co., Youngstown, O.
Seymour Mfg. Co., Seymour, Conn.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., St. Louis, Mo.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Co., Youngstown, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE AND STRIP—Brass, Zinc
Platt Bros. & Co., The, Waterbury, Conn.

This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

THE WATSON MACHINE COMPANY

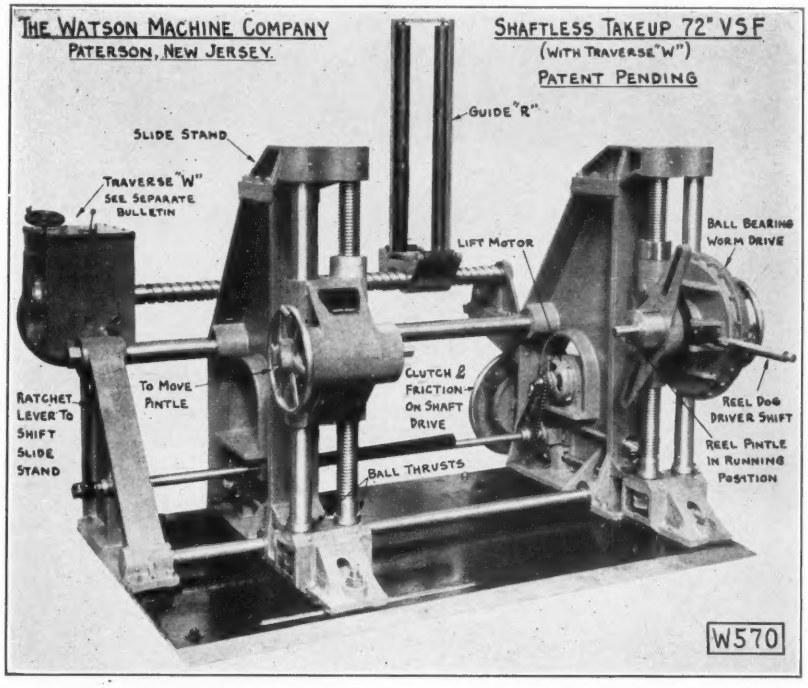
ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ENGINEERS - FOUNDERS - MACHINISTS

SHAFTLESS TAKEUPS TYPE "V"

For Heavy Duty
(Patent No. 1825218)



THE MOST IMPORTANT SINGLE POINT OF THIS TYPE THE ELIMINATION OF THE REEL SHAFT

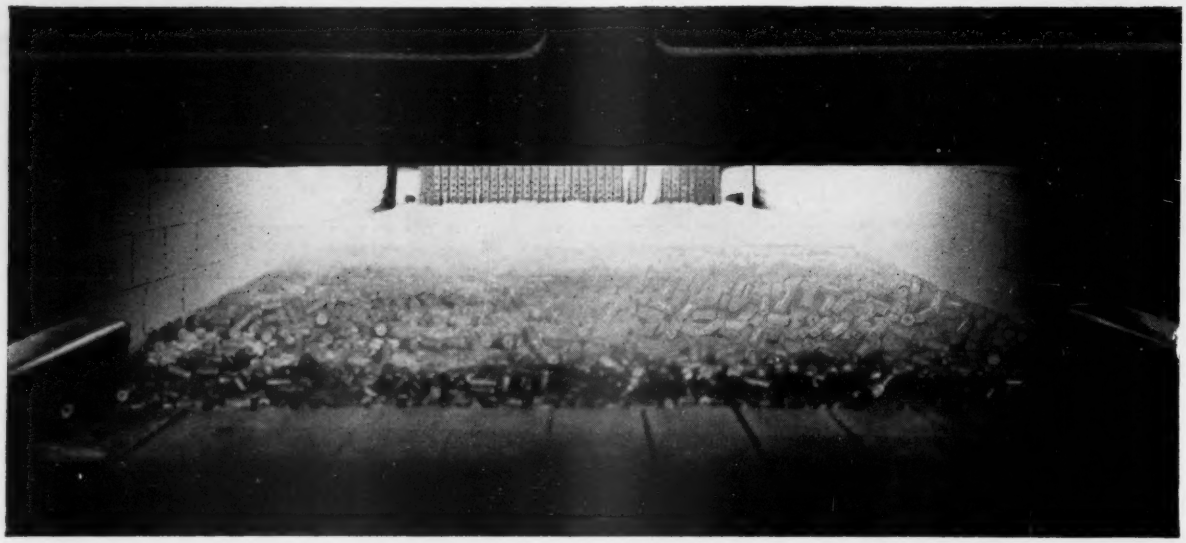
The elimination of minor injuries to operator in handling large reel shafts is also a point of considerable value.

Two sizes are built—

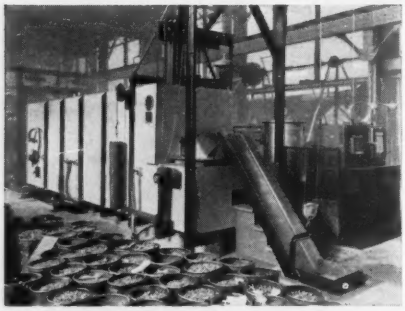
72″ for loads up to 6 tons (picking up 36″ or larger reels from base).

96″ for loads up to 10 tons (picking up 48″ or larger reels from base). The multiple disc slip-friction is adjustable in operation and this, with the slack takeup handwheel combined with positive clutch, centers drive control at the stand in a convenient position.

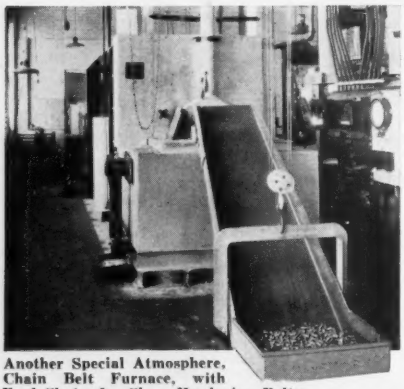
ELECTRICAL WIRE AND CABLE
WIRE ROPE and CORDAGE MACHINERY



LOOK INTO THIS——



Controlled Atmosphere, Continuous Chain Belt Conveyor Furnace, Scale-Free Hardening Bolts.



Another Special Atmosphere, Chain Belt Furnace, with Feed Chute, for Clean Hardening Bolts.

Investigate the Advantages of These Continuous, Chain Belt Conveyor Special Atmosphere Furnaces

For Scale-Free Heat Treating

Bolts, Springs and Other Miscellaneous Small and Medium Size Products

The above illustration shows the interior of one of our standard, continuous chain belt conveyor furnaces.

These furnaces are now being built for operating with special protective atmosphere for scale-free heat treating and clean and bright hardening. Several installations thus equipped are shown at left and below.

The material is loaded directly onto our rugged, cast link, heat-resisting alloy belt conveyor . . carried thru these furnaces in our inexpensive protective atmosphere and discharged absolutely free from scale . . no pans or trays are used . . 100% net material.

The special protective atmosphere is provided by an Elfurno generator furnished with the furnace.

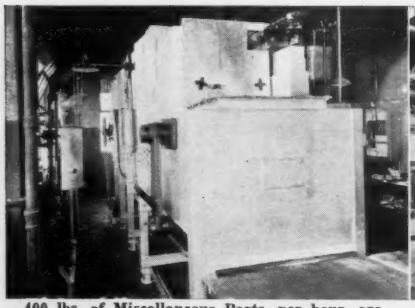
Time and temperature are automatically controlled as well as the atmosphere . . insuring accurate, uniform, scale-free results.

These furnaces are built in five standard sizes with capacities ranging from 300 to 1700 pounds per hour.

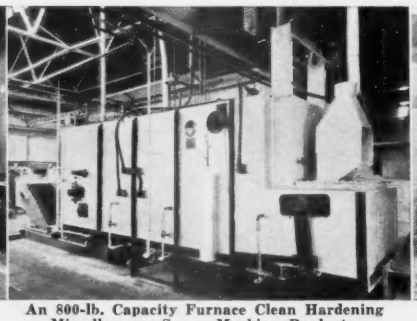
Ask for samples of material heat treated in these furnaces
Investigate their advantages for your products.

The Electric FurnaceCo., Salem, Ohio

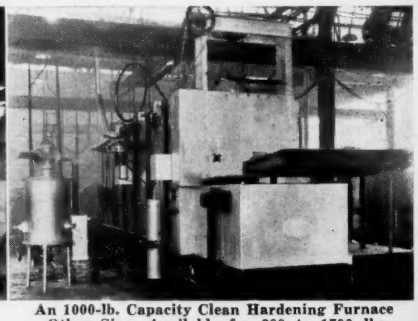
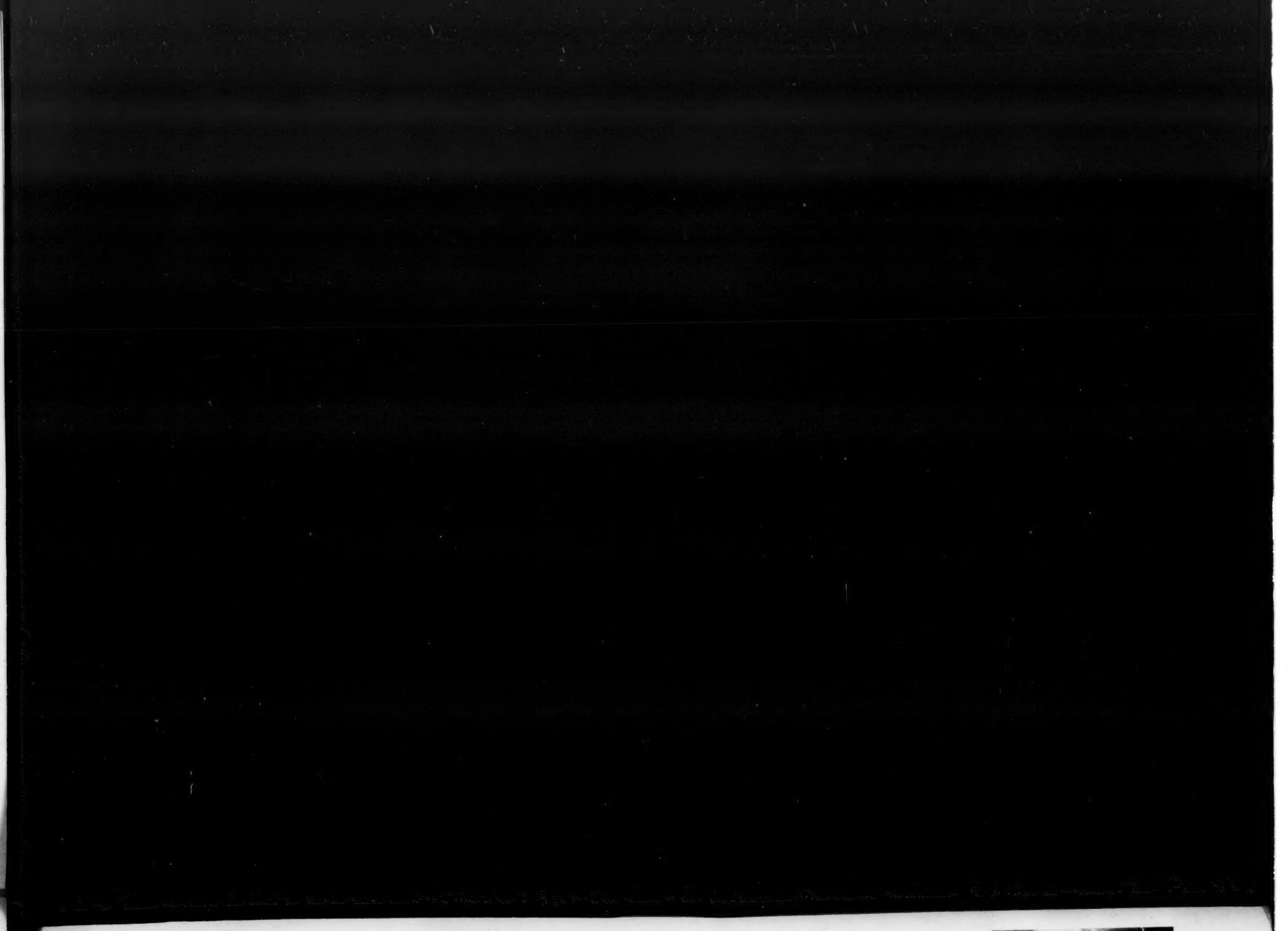
Electric and Fuel Fired Furnaces for every Industrial Heating Process.



400 lbs. of Miscellaneous Parts, per hour, are Clean Hardened in this Continuous Furnace.



An 800-lb. Capacity Furnace Clean Hardening Miscellaneous Screw Machine Products.



An 1000-lb. Capacity Clean Hardening Furnace —Other Sizes Available for 300 to 1700 lbs. per hour.